INCIDENCE AND ASSOCIATED FACTORS OF PRESSURE ULCER AMONG PATIENTS ADMITTED TO ADULT INTENSIVE CARE UNIT JIMMA UNIVERSITY MEDICAL CENTER, JIMMA TOWN, ETHIOPIA

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JIMMA UNIVERSITY

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Abstract

Background: *Pressure ulcer is defined as a localized injury to the skin and/or underlying tissue usually over a bony prominence as a result of pressure, or pressure in with shear and/or friction. People most at risk of pressure ulcers are those with a medical condition that limits their ability to change positions or co-morbidity confines them to a bed for a long time. Once it developed pressure ulcer is a common cause of morbidity and mortality in hospitalized patients, and also require high cost for treatment.*

Objectives; *The main objective of the study was to assess the incidence and associated factors of pressure ulcers among patients admitted to the adult Intensive care unit of Jimma Medical Center, southwest Ethiopia.*

Methods: *Institutional-based cross-sectional study was conducted from August 1 to December 31, 2021. A pre-designed structured questionnaire was used to collect socio-demographic and some clinical data. In addition to these, the Braden scale risk assessment tool was used to evaluate for pressure ulcer risk during admission. Data were analyzed by using Statistical Package for the Social Sciences (SPSS) version 20. Descriptive analysis, bivariate, and multivariate logistic regression were applied to see the association between dependent and independent factors.*

Results: *The overall incidence of pressure ulcers among adult intensive critical care admitted patients was 16.2%(22). Based on the EPUAP grading scale 11(50%) developed stage II pressure ulcers (PU) and the sacral anatomical site was the main one. length of stay≥21 days [OR 6.53(OR 1.02-41.9), P=0.048], not position change [OR 3.94(1.05-14.8), P=0.043], sedation [5.07(OR 1.32-19.51), P=0.018], vasopressor[OR 5.06(1.29-19.92), P=0.02], and friction problem[OR 6.32(1.1-36.37),95%CI, p=0.039] had significant association with pressure ulcer.*

Conclusion: *In this study incidence of pressure ulcers was high. Prolonged length of stay in the ICU, the problem of friction and shearing forces, change of patient's position by nurses, use of vasopressors, and sedatives were significantly associated with the presence of pressure ulcers. Healthcare providers' particularly nurse's contribution is vital in the prevention of PU for ICU admitted patients by frequent positioning and maintaining head of the bed at lower possible level. Also decreasing depth or duration of sedation, decrease LOS in ICU, and appropriate use of vasopressors are.*

Keywords: *Pressure ulcer, pressure injury, intensive care unit, Jimma medical center.*

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My deep appreciation and thanks will also be extended to Jimma university medical center especially the SICU staff and residents for their cooperation during the data collection and follow-up time of this research.

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List of abbreviations and Acronyms

CHF- Congestive Heart Failure

DM- Diabetes Mellitus

EPUAP- European Pressure Ulcer Advisory Panel

ERB- Ethical Review Board

ESA- Ethiopian Society of Anesthesiology

GCS- Glasgow-Coma Scale

HINARI- Health Inter-Network Access to Research Initiative

JU –Jimma University

JMC- Jimma Medical Center

ICU – Intensive Care Unit

LOS -length of stay

MICU- Medical intensive care unit

NHS- National Health Service

NPU-National pressure Ulcer

NHMIS- National Health Management Information System

NPO- Nothing-Per Oss

NPUAP -National Pressure Ulcer Advisory Panel

PAD- Peripheral arterial disease

PI - Principal Investigator

PU – Pressure ulcer

PICU- Pediatrics intensive care unit

SCI- Spinal Cord Injury

SICU- Surgical intensive care unit

UK- United Kingdom

SPSS- Statistical Package for the Social Sciences

WHO – World Health Organization

CHAPTER ONE:-INTRODUCTION

1.1 Background

Pressure ulcer (PU) is defined by National Pressure Ulcer Advisory Panel (NPUAP) and European Pressure Ulcer Advisory Panel (EPUAP) as localized injury to the skin and/or underlying tissue usually over a bony prominence as a result of pressure, or pressure in combination with shear and/or friction(1). A PU otherwise called bedsore, pressure ulcer/necrosis, decubitus/ischaemic ulcer, occurs as a result of prolonged and high pressure more than the capillary pressure or pressure in combination with shear force, friction burns, and skin irritation by moisture(2).

 Prolonged pressure from lying or sitting on a specific part of the body will impede capillary blood supply to an area and thus limit the delivery of oxygen and nutrients to tissue, placing patients at risk for skin break injury, soft tissue ischemic necrosis, and the progressive destruction of affected areas when pressure applied is above expected capillary pressure between 10 and 30 mmHg (3). PU usually occurs over the bony prominence of sacral, ischial, heal, occiput, ear lobes, elbows, and trochanter depending on the position of the patient which results in a pain full and slow healing(4).

PU develops as compressive, friction, and shearing forces overwhelm the tissues' ability to withstand those forces, resulting in pressure damage that can range from superficial disruption of the epidermis to deep ulceration involving muscle and associated connective tissues(5). The relative importance of the type and magnitude of the destructive forces and the characteristics affecting the tissues' tolerance for those forces are not well understood(6).PU differs in size and the severity of affected tissue layers, with the latter ranging from skin erythema to muscle and underlying bone damage(7).

PU stages are distinct phases or periods in the course of localized damage to the skin and underlying tissue.

Stage I: Intact skin with non-blanch able redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching (to lose color); its color may differ from the surrounding area.

Stage II: Partial thickness loss of dermis presenting as a shallow open ulcer with a red-pink wound bed, without slough (deep muddy hole wound). This may also present as an intact or open/ruptured serum-filled blister.

Stage III: Full thickness tissue loss, subcutaneous fat may be visible but bone, tendon, or muscles are not exposed. Slough may be present but does not obscure the depth of tissue loss.

Stage IV: Full thickness tissue loss with exposed bone, tendon, or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling. **Unshakeable:** Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green, or brown) and/or eschar (tan, brown or black) in the wound bed(8).

Critically ill patients in ICU(intensive care unit) are considered to be at greatest risk for pressure ulcer development, as this patient group is likely to present with great attention, may require MV and consequent administration of sedation and pharmacological drugs potentially reducing peripheral circulation and be immobile(9). These patients who are identified as being at risk should have a management plan to prevent the development of pressure ulcers, improve healing and prevent complications of existing pressure ulcers, so that aggressive, ongoing pressure ulcer prevention programs, including thorough skin assessment and care, frequent repositioning and careful selection of support surfaces have demonstrated significant reduction of pressure ulcer incidence and time taken for treatment as well as dramatic cost savings(9).

According to recommendations from the Agency for Health Care Policy and Research, bedridden patients should be repositioned every two hours(2).To minimize shear, the head of the bed should not be elevated more than 30 degrees and should be maintained at the lowest degree of elevation needed to prevent other medical complications, such as aspiration and worsening congestive heart failure symptoms(10). PU is a serious health concern for elders in acute care, long term care, and home care settings, it may also result in morbidity and mortality, and with high cost in terms of human suffering and cost of treatment, measures reduce this problem in volvesskinc are, diet, hygiene, lifestyles, position changes and supportive devices(11).

Prevention PU requires an ongoing risk assessment, consideration of casual factors, implementation of prevention strategies, and the selection of appropriate use of pressure-relieving devices(1). When an assessment identifies a patient at risk of PU, interventions should be implemented immediately, but once a PU is a developed treatment involves reducing pressure on the affected skin, caring for wounds, controlling pain, preventing infection, and maintaining good nutrition(1).PU incidence has been determined to be a quality of care indicator for long-term care facilities(12).

1.2 Statement of Problem

PU is a serious condition that spreads across all the medical disciplines and considerable health care problems worldwide which causes considerable harm to patients, including hindering recovery, adverse patient outcomes, and contribute to depression, loss of function and independence, increased incidence of infection, and sepsis, additional surgical interventions, significant economic costs, increase workload and prolonged hospital stays(13).

PU can reduce the overall quality of life due to pain, treatments, and increased length of institutional stay, and may also contribute to mortality in some patients(14).The development of PU is complex and multi-factorial. Different studies revealed that PU development can be associated with health facility and patient condition such as; Age, length of hospital stay, nutritional status, diseases condition which limit mobility and activity, level of the mental status of the patient, condition of bed, and lack of sufficient nursing care in general(15–18). Moreover, the researcher attempted to scientifically prove some of the risk factors such as interface pressure, and skin moisture that has not yet been proven in previous studies in an ICU(19).

Patients admitted to ICU are more susceptible to developing PU because of additional co-morbidity who are already physiologically compromised, ventilated, sedated, old age, critical illness may hemodynamic instability and oxygenation disorders, low Glasgow-come Scale (GCS)(20). PU is one of the most underrated medical problems in critical care patients(17). Data on PU-related mortality in the ICU is scarce, however, ample data exist to exemplify the morbid character of PU in other settings (21). Despite the great significance of the problem, few reports quantify the association between risk factors and the appearance of PUs in the ICU, and some of those published are based on general presumptions (22).

PU affects millions of people and remains a major health problem, but the burden & incidence rates of PU vary greatly with the health care settings(23). The first step for pressure ulcer prevention is the assessment of the risk for acquiring a PU, after assessing the patient's risk for acquiring a PU, a decision can be made as to what strategies should be used to prevent pressure ulcers(15)

In addition, an accurate risk assessment will enable prompt recognition and treatment of pressure injuries that occur among high-risk patients, which is important because early-stage pressure

injuries are highly treatable(24). PU prevalence and incidence are indicators of the burden of the condition and quality of care(25).

JMC is one the largest medical center in southwest Ethiopia providing service to large populations with different wings which give service to the patients. Among these, ICU is one in which patients stay in it for a prolonged time for treatment which may lead to PU and related complications, morbidity, and mortality. Though some studies are focusing on the prevalence and risk factors of PU in hospitalized patients, in my opinion, there are no reported studies regarding the incidence and associated factors of PU in ICU patients in Ethiopia. In many studies, the incidence and risk factors of PU vary from center to center and preventive methods are commonly used for the patient at risk.

Therefore, this study will emphasize assessing the burden of PU and associated factors among patients admitted to the ICU setting of JMC, southwest Ethiopia so that identification of specific risk factors for ICU-related PU development is important for individualized preventive intervention planning and initiation to reduce the incidence of PU.

1.3 Significance of the Study

The study provides basic information on the incidence and associated risk factors of PU that have a valuable contribution to the academic community, service providers, and health care professionals.

Therefore, assessing the incidence and identifying risk factors that influence the occurrence of PUs in ICU is important for the early identification of patients at risk for possible interventions, to reduce the burden and increase the quality of care. It also provides practical evidence to support an essential link between PU and associated risk factors for the prevention and early detection which will lower the development of PU and associated morbidity.

Researchers can use the data obtained from this study as a reference source for the future.

Health policymakers can utilize it for planning and developing the necessary strategies to strengthen the efforts towards the prevention of PU in ICU.

CHAPTER TWO:-LITERATURE REVIEW

Some studies that are established in incidence and associated factors of PU thus suggest the usefulness of these studies for diagnosis and predicting the occurrences of PU by identifying some risk factors. The literature search involved reviewing mainly three online databases, Pub Med, HINARI, and Google scholar.

Data from a worldwide perspective done in Belgium, a one-day point-prevalence study conducted on prevalence, associated factors, and outcomes of PU in ICU patients revealed that the overall prevalence was 26.6% with 18.0% of stage II or worse and an ICU-acquired prevalence was 16.2%, among all units, ICU-acquired PU was 59.2%, the severity of pressure injury showed a gradually increased association with hospital mortality. This study identified a broad range of factors including age, length of ICU stay, diabetes, MV, vasopressor support, hypotension, and cardiovascular disease, and suggest that an interplay of these factors increases the probability of PU development(26)

According to a retrospective cohort study done in the UK to evaluate the management of PU starting from initial presentation patients characteristics, comorbidities, and pattern of care was included, the burden of PU was 9%, among these; 11% grade1, 7% grade 2, 60% grade 3 PU, 10% grade 4 and 12% had an un-stageable PU and mean National Health Service (NHS) cost of wound care in clinical practice over 12 months was an estimated £8720 per PU, however, this varied between £1382 per patient with a grade 1 PU and >£8500 per patient with a grade 2, 3 or 4 PU or an unstageable PU(27).

According to data from a prospective cohort study in 9 medical-surgical ICU conducted in Granada on PU incidence and its associated risk factors during their ICU stay, Of the 299 patients on MV, 8 already had PU at ICU admission and 47 developed a new PU (≥grade II) sometime during their ICU stay, a cumulative incidence of 16%, the mean (SD) length of stay before PU onset was 14 (13) days (range, 1-54 days), 2.8% of the 181 patients with 7 days or less on MV and in 35.6% of118 patients with more than 7 days on MV, the most common PU sites were sacrum (66%) and ischium (15%)(22).

 According to a prospective cohort study conducted in Spain, on incidence and risk factors associated with the development of PU in ICU patients indicates that incidence of PU was 8.1%, and the incidence rate was 11.72 PU for 1,000 days of intensive care units stay; 40.6% of

pressure ulcers were of stage I and 59.4% of stage II, mainly in the sacrum median time in days to PU onset was 7 days with a minimum of 1 day and a maximum of 34 days(28).

According to a longitudinal study conducted in Germany on Incidence, prevention, and treatment of pressure ulcers in ICU patients revealed the incidence of PU was 3.3% (4.5% in nephrological patients and 2.9% in surgical patients), during the patients' stay at the intensive care units six pressure ulcers developed newly and five pressure ulcers healed. The mean length of stay for all patients was 7 days, while the length of stay for patients with new pressure ulcers was 9.5 days. In this study LOS, comorbidity, prevention, and treatment of PU were included (29).

According to data from a cross-sectional study conducted in Dutch on prevalence, risk factors, and prevention of PU ICU showed that prevalence of PU was 28.7%, the risk factors associated with PU were age, the time elapsed since admission, infection, and total Braden score (30)

A cross-sectional study conducted in Netherland, on PU prevention in ICU patients results revealed that the total prevalence of pressure ulcers was 27.2%, the highest prevalence of pressure ulcers was among surgical patients with 39%, while the lowest prevalence was among interdisciplinary patients with 18.8%.There is no significant difference among ICU specialties regarding age, body mass index, Braden score, and the number of patients at risk for pressure ulcers(20).

A prospective cohort design was used to identify risk factors for PU development in an ICU in Indonesia, total subjects admitted to the ICU were 297 patients of which, 191 patients were excluded from this study for various reasons the study showed that the incidence of PU was 33.3%, most of the PU was located at the sacrum (73.7%) and heel (13.2%), only three patients had more than one pressure ulcer. According to this study, there was no significant difference based on age and length of stay, the findings support the importance of interface pressure, skin moisture, body temperature, and smoking as risk factors associated with PU development (19).

According to the cross-sectional survey conducted in Sweden on the prevalence and associated factors of PU shows that the prevalence of PU was 18.5% in acute care, 23.3% in intensive care, 8.3% in neurology, and 59.3% in geriatric care(31).

A Cross-sectional study conducted in Palestine on PU Prevalence and potential risk factors among ICU patients showed that the prevalence of pressure ulcers in the ICU departments was 33%, and the prevalence of PUs when excluding stage one was 7.3%.The common stage for pressure ulcers was stage one. It was also determined that the most common risk factors for the

development of pressure ulcers were the number of days in the hospital, moisture, and friction(32).

According to a prospective cohort study conducted in ICU of Iran on incidence and risk factors of PU shows, the overall PU incidence in ICU was 25.6%, most PU was stage I, and no patient developed a stage IV ulcer. PU occurred in 62 smoker patients and 28 of them area non-smoker who showed significant differences. Besides smoking, age, length of stay, fecal incontinency, DM, anemia, and trauma were significantly associated with pressure ulcers(33).

A prospective descriptive study conducted in University Hospital Leuven on the incidence and associated risk factors of PU in ICU patients shows that cumulative incidence of PU grade II to IV occurring at least 48 hours after admission on ICU was 20.1% The following variables were positively associated with: history of vascular disease, treatment with Dopamine or Dobutamine, intermittent hemodialysis, mechanical ventilation. Also, preventive measures were statistically positively associated with pressure ulcers grade: turning, floating heels, alternating mattresses, adequate prevention(34).

Data from a prospective cohort study conducted in Chine on PU in ICU shows that incidence of PU in Surgical ICU was 31.4%, the diagnoses for ICU admission included postoperative complications 38.2%, respiratory failure 30.4%, trauma 16.7%, and organ failure 12.7%, among the patient who developed PU 56% of them were developed PU within 7 days following admission to the ICU Lower moisture content of the stratum corneum and higher skin surface pH at the lower sacrum and hip were risk factors for PUs, whereas scapular and heel skin barrier factors were not(35).

Data from a cross-sectional study done in Tunisia, a total of 473 patients were included showed the prevalence of patients with PU was 5.3% with a prevalence of 4.7 % of nosocomial PU. Nearly 10% of patients had a moderate or a high risk of developing PU with a Braden score of less than 18. The most frequent sites were sacrum and heels. Stages 3 (46.4%) and 2 (37.5%) were themain stages described(36).

A cross-sectional study was conducted on the prevalence of PU and its associated factors among patients admitted to ward in JUMC, Ethiopia, revealed that 9.6 % of them had PU, out of this 81.2% were developed after admission, from the total of PU identified, 18.5% were stage I, 44% was stage II, 25% were stage III and 12.5% were stage IV. Braden scale is a predictor of PU and

other factors LOS, admitting ward, frequency of positioning, smoking, and use of preventive measures were included in the variable(37).

Conceptual framework
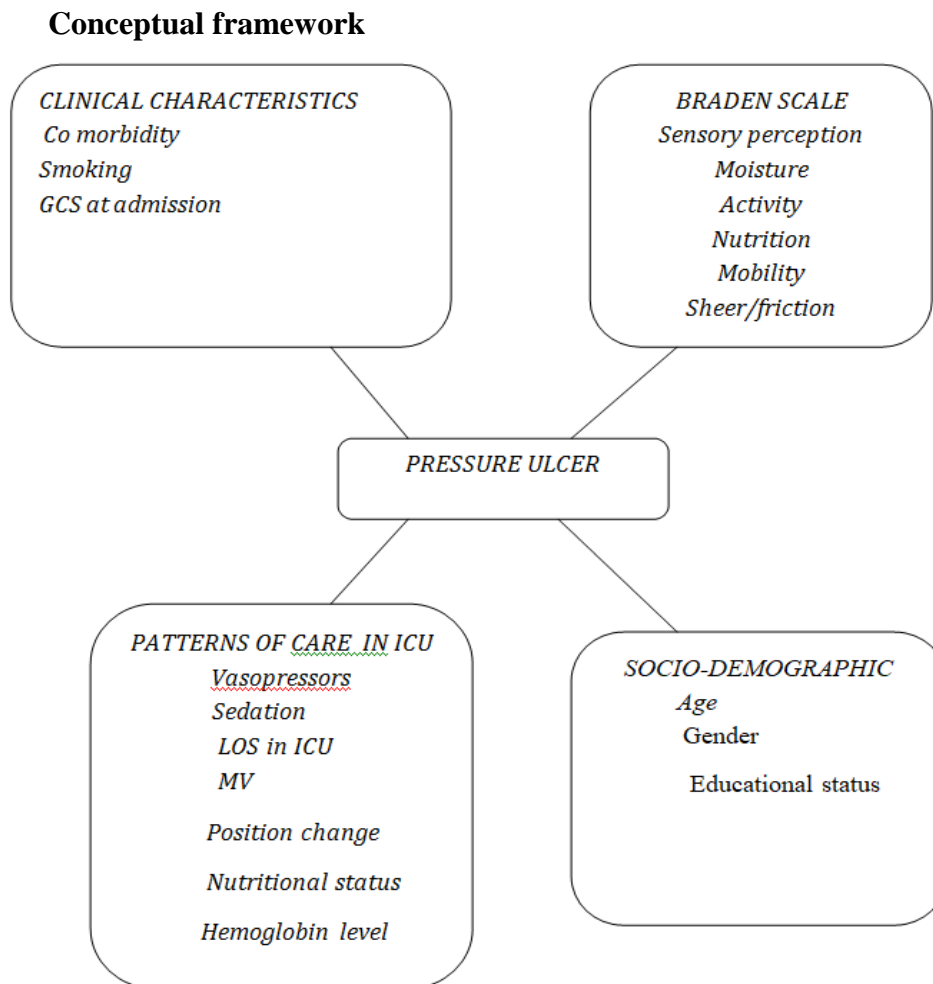
Figure 1: Conceptual framework

CHAPTER THREE:-OBJECTIVES

3.1. General Objective

- To determine incidence and risk factors of PU among patients admitted to adult ICU of JMC from August 1 to December 31, 2021, southwest Jimma Town, Ethiopia.

3.2. Specific Objectives

- To determine the incidence of PU among patients admitted to adult ICU of JUMC, Jimma town, Ethiopia.
- To identify risk factors for the development of PU of patients admitted to adult ICU of JMC from different wards in JMC Jimma town, Ethiopia.

CHAPTER FOUR:-METHODS AND MATERIALS

4.1. Study Area

The study was conducted in JMC Jimma town, Oromia regional state, located 352 km southwest of the capital city Addis Ababa. It is inaugurated as a new Medical center on December 08, 2018, as the only teaching and referral hospital in the south-western part of the country. It has a bed capacity of 671 beds and has around 2000 staff. It is delivering services for almost 15000 inpatient, 160000 outpatient attendants, 11000 emergency cases, and 4500 deliveries in a year coming to the hospital from the catchment population of more than15 to 20 million people. ICU gives services for critically ill patients such as patients with organ failure (respiratory failure, renal failure…), Coma, shock, postoperative observation, and monitoring of the surgical patients. Annually the ICU provides for at least 500 critically ill patients.

The hospital has five ICUs namely:

1. Surgical Intensive Care Unit (SICU):With a capacity of 6 beds, three functional Mechanical Ventilator(MV), 20 Staff nurses, four   senior physicians, and thirty-one monthly   rotating anesthesia, critical care, and pain medicine specialty residents
2. Pediatric Intensive Care Unit (PICU): With a capacity of four beds, has two functional MV, one pediatrics Intensivist, and twelve nurses
3. Medical Intensive Care Unit (MICU): With a capacity of six beds, nine nursing staff, and one MV
4. NICU: With a capacity of 25 beds and twenty-six nursing staffs
5. COVID 19 treatment ICU: With a capacity of six beds, has four functional MV, has five nursing staffs and two anesthesia and Internal Medicine residents, one from each department

4.2. Study Design and Study Period

- An Institutional based cross-sectional study was conducted to determine the incidence and associated risk factors of PU among patients admitted to adult ICU of JUMC from August 1 to December 31, 2021, Jimma town, Ethiopia.

4.3. Population

- **Source population:** All patients who were admitted to ICU JMC.
- **Study population:** Patients who were admitted to SICU and MICU of JMC, during the study period.

4.4. Inclusion and Exclusion Criteria's

4.4.1. Inclusion criteria's
All patients who were stayed in ICU for greater than or equal to 24hours during the study period were included in the study.

4.4.2. Exclusion criteria
- All patients who have already developed PU before admission to JMC
- Age less than 18 years.
- Patients whose physical examination and skin assessments are worsens medical conditions.

4.5. Sample Size Determination and Sampling Technique

4.5.1. Sample size calculation:
The sample size was calculated using the single population proportion formula. The assumptions considered during the determination of the sample size for this study include:

- P=0.134 (magnitude of PU in Wolaita Sodo University was 13.4%)
- Level of confidence, 95% confidence level =1.96
- d= margin of error = 5%

$$n = \frac{(Z\alpha/2)^2 \, p \, (1-p)}{d^2}$$

Based on the above assumptions the calculated sample size would be 178. Since our study population is, less than 10,000 correction formula will be used, where:-
- n= calculated sample size= 178
- Nt= Average number Source population from2020/ 2021 in a year   = 500
- N= final calculated sample size= n/1+ (n/Nt)= 136

4.5.2. Sampling Technique
A conveniences ampling technique was used and all eligible patients who are going to be consecutively admitted to the adult ICU of JMC during data collection periods.

4.6. Variables

4.6.1. Dependent variable

- Pressure ulcer.

4.6.2. Independent variable

- Socio-demographic status
- Comorbidity
- Smoking
- GCS at admission
- Nutritional status
- Braden scale
- Vasopressors

- Sedation,
- LOS in ICU
- MV
- Position change
- Bedsheet change
- Nutritional status
- Hemoglobin level

4.7. Data Collection Tool and Procedure

Structured questionnaires were developed by searching different scholars and a previous research paper on a similar study. Relevant sociodemographic data, physical examination was done to assess the presence or absence of PU, clinical characteristic, and risk assessment by using a checklist adapted from the Braden scale was used to collect data. The questionnaire was translated into local language by language experts and translated back to English by another language expert for consistency. Trained Anesthesiology residents were involved in data collection and supervision was done by the principal investigator daily.

4.8. Data entry and Analysis

Data were checked for completeness, cleaned, sorted, categorized daily, and entered into Epi data manager (V:4.6.0.2) then exported to SPSS version 20 for analysis. Descriptive statistics were used to summarize and presented by tables, graphs, and texts. Bivariate and multivariate logistic regression analyses were performed to determine the association between the dependent and independent variables. The multivariable logistic regression model was analyzed with backward likelihood and stepwise method for variables with a p-value of < 0.25 in the bivariate binary logistic regression. The model fitness of the final multivariate logistic regression was checked using Hosmer and Lemeshow test. A final p-value < 0.05 in the multivariable regression model was considered statistically significant.

4.9. Data Quality Control

Questioners were pretested before the actual data collection and corrections and adaption of the tool were made including the addition of certain important questions. Data collectors were trained on the data collection process and procedures for half day. Filled questionnaires were checked daily for completeness, clarity, and accuracy. Data cleaning was undertaken before entry and analysis.

4.10. Operational Definitions

According to EPUAP Pressure Ulcer Staging(1).

Stage I PU: Intact skin with signs of impending ulceration, non-branch able erythema indicating reactive hyperemia

Stage II PU: A partial-thickness loss of skin involving epidermis and dermis.

Stage IIIPU: A full-thickness loss of skin with extension into subcutaneous tissue but not through the underlying fascia.

Stage IV PU: A full-thickness tissue loss with extension into muscle, bone, tendon, or joint capsule

Unstageable: Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green, or brown) and/or eschar(tan, brown or black) in the wound bed
Sensory Perception: level of response of the patient for touch sensation.

Mobility: the ability of the patient to change position within abed or to move out of the bed
Braden Scale: is a summated rating scale made up of six subscales scored from 1 -3 or 4,
For total scores that range from 6-23. A lower Braden Scale Score indicates a lower level of functioning and, therefore, a higher level of risk for pressure ulcer development

4.11. Ethical considerations

Ethical clearance was obtained from the institutional review board (IRB) of the Institute of Health, Jimma University. After ethical approval was received, permission to conduct the study was obtained from the Head of the Department of Anesthesiology and the chief clinical director of the JMC. A support letter from Jimma University Health Science Research Coordinating Office was written to JMC. Written informed consent was obtained from each study participant or parents/guardians of the participants. Patient confidentiality, equity of services, and the interests of patients were ensured during the study period. All data collected during the study were treated with strict confidentiality and used only for this study.

4.12. Plan for dissemination of results

The study report will be submitted to Jimma University and department anesthesiology and critical care. The results were also submitted to the Jimma Medical Center administration. The study abstract will be submitted to local associations like ESA to present the study results during continuous medical education events organized through this association. Efforts will be made to submit this study's outcome to international or national peer-reviewed reputable journals for publication

CHAPTER FIVE:-RESULTS

5.1 Socio-demographic characteristics of study participants

A total of 136 patients admitted to adult ICU JMC were included in this study. The mean (±standard deviation) age of the respondent was 42.86(±18.17) and majority (44.9%) of them were fall in the age range of 18-35. The majority 76(55.9%) and 87(64%) of the respondents were male and muslims followers respectively. Majority of the study participant's 97(71.3%) of study participants were married and 88(64.7%) of them were rural residents. About 33.1% of the patients were unable to read and write

Table 1: socio demographic characteristics of study participants who were admitted to JMC ICU, Ethiopia (n=136)

Variables	Frequency	Percentage
Age		
18-35	61	44.9
36-55	39	28.7
>55	36	26.5
Sex		
Male	76	55.9
Female	60	44.1
Marital status		
Single	33	24.3
Married	97	71.3
Divorced	3	2.2
Widowed	3	2.2
Religion		
Catholic	1	0.7
Muslim	87	64
Orthodox	21	15.4
Protestant	25	18.4
Others	2	1.5
Place of residence		
Urban	48	35.3
Rural	88	64.7
Level of education		
Not educated	45	33.1
Primary school	42	30.9
secondary school	34	25
higher education	15	11
ICU ward		
SICU	96	70.6
MICU	40	29.4

5.2 Clinical characteristics of study participants

The most identified co-morbidity was cardiovascular diseases with 20(14.7%). The GCS of study participants ranges from 3-15, and the median GCS of the patients was 12 with an interquartile range of (IQR±5) scores. Regarding cigarette smoking, most of them 105(77.2%) were never smoked. Among the total study participants, 56(41.2%) of them spends ≥21 days in the ICU. Also, patient's position change on bed service given for 89(65.4%) and among them 46.3 % were repositioned every 2 to 3 hours, 16.2% were repositioned every 4 hours, 2.9 were repositioned 4 times per day.

Table 2: Clinical characteristics of study participants who were admitted to JMC ICU, Ethiopia (n=136)

Variables	Frequency	Percentage
Co-morbidity		
Yes	73	53.7
No	63	46.3
Types of co-morbidity		
Cardiovascular disease	20	14.7
Respiratory disease	6	4.4
Neurologic disease	13	9.6
Endocrine disease	6	4.4
Infectious disease	2	1.5
Renal disorder	6	4.4
GIT disease	9	6.6
Malignancy	11	8.1
GSC score		
≤8	29	21.3
9-12	46	33.8
≥13	61	44.9
Smoking story		
Current	7	
Previous	24	5.2
Never smoke	105	17.6

		77.2
Length of stay		
≤6 days	54	39.7
7-20 days	26	19.1
≥21 days	56	41.2
Position change		
yes	89	65.4
no	47	34.6
Frequency of position change		
Every 2 to 3 hours	63	46.3
Every 4 hours	22	16.2
4 times per day	4	2.9
Hgb level		
Yes	43	31.6
No	93	68.4
Mechanical ventilation		
Yes	82	60.3
No	54	39.7
Nutritional status		
NPO		
Diet	66	48.5
	70	51.5
Frequency of bed sheet changes		
Once	94	69
Two or three times	42	31

Among patients who developed PU in ICU 81.8% of them were from SICU
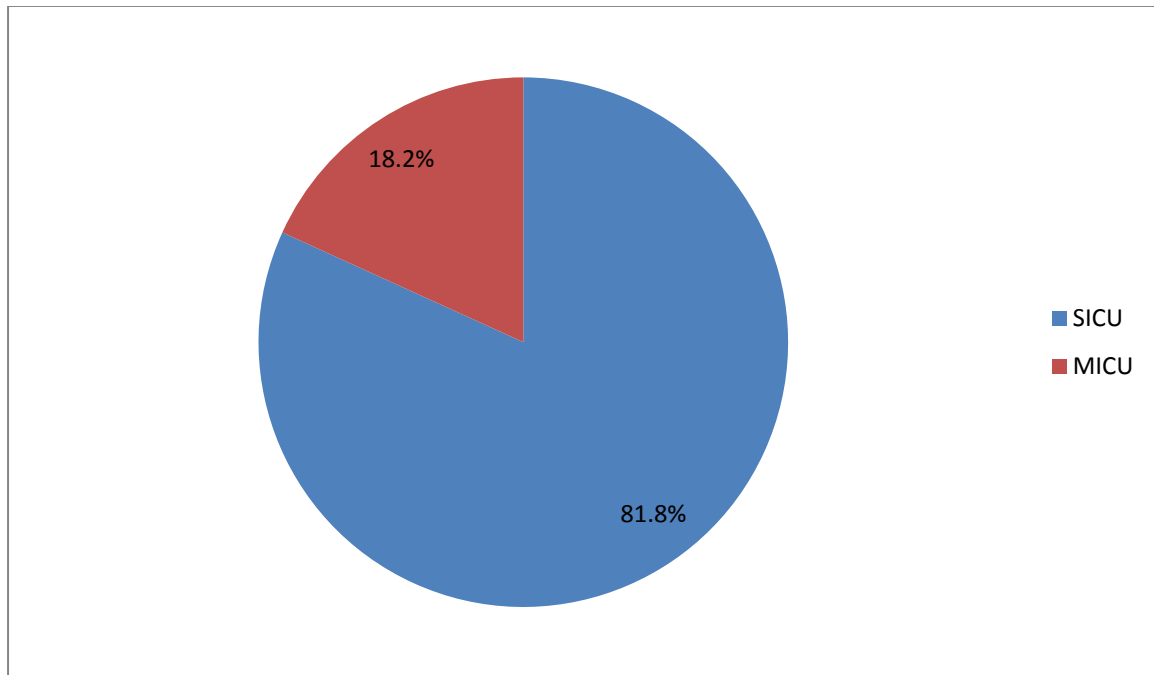
Figure 2: Distribution of patients who developed pressure ulcer by ward admitted to JMC ICU, Ethiopia (n=136)

5.3 Braden scale risk assessment results of the patient

According to Braden skill risk assessment 31(22.8%) of the study, participants had completely limited sensory perception, whereas 38(27.9%) were constantly moist, 57(41.9%) and 33(24.3%) of them were bedfast and completely immobile respectively. Also, 38(27.9%) of patients were categorized as having very poor nutritional status and 39(28.7%) of them had friction and shear potential problems.

Table 3: Braden scale pressure ulcer risk assessment characteristics of respondents who were admitted at JMC ICU, Ethiopia (n=136)

Braden scale	Category	frequency	Percentage
Sensory perception	Completely limited	31	22.8
	Very limited	24	17.6
	Slightly limited	31	22.8
	No impairment	50	36.8

Moisture	Constantly moist	38	27.9
	Very moist	34	25
	Occasionally	30	22.1
	Rarely moist	34	25
Activity	Bedfast	57	41.9
	Chair fast	31	22.8
	Walks occasionally	34	25.0
	Walks frequently	14	10.3
Immobility	Completely immobile	33	24.3
	Very limited	45	33.1
	Slightly limited	41	30.1
	No limitation	17	12.5
nutrition	Very poor	38	27.9
	Probably inadequate	30	22.1
	Adequate	36	26.5
	Excellent	32	23.5
Friction and/shear	Problem	38	27.9
	Potential problem	39	28.7
	No apparent problem	59	43.4

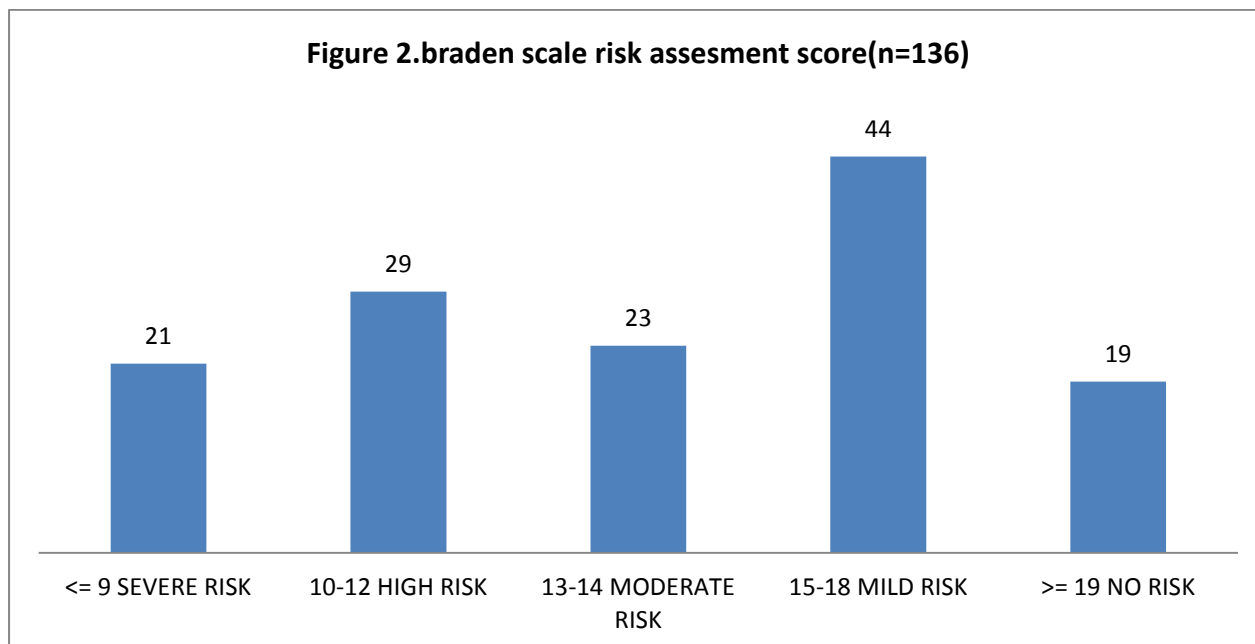Figure 2.braden scale risk assesment score(n=136)

Figure 3: Braden scale risk assessment score (n=136)

According to the Braden risk assessment score, 21(15.4%) of the study participants were at severe risk for PU development and 19(14%) of them had no risk.

5.4 Incidence and characteristics of pressure ulcer among study participants

The current study showed that the overall incidence of PU was 22(16.2%). Based on the EPUAP grading scale 11(50%) developed stage II PU and the sacral anatomical site was the main one.

Table 4:Incidence and characteristics of PU among patients admitted at JMC ICU, Ethiopia (n=136)

Pressure ulcer	YES	22	16.2
	NO	114	83.8
Anatomic site	Sacral	8	36.4
	Greater trochanter	6	27.3
	Heel	2	9.1
	Sacral and greater trochanter	1	4.5
	Occipital and greater	1	4.5
	trochanter	1	4.5
	Heel and greater trochanter	3	13.7
	More than two sites		
Stage of pressure ulcer	Stage I	6	27.3
	Stage II	11	50
	Stage III	1	4.5
	Stage I and II	2	9.1
	Stage II and III	2	9.1

5.5 Factors associated with the occurrence of pressure ulcer

Independent variables were analyzed against one dependent variable (PU) to assess if there is an association. Primarily, one independent variable with one dependent variable was checked to select the independent variables that were a candidate for multivariate logistic regression. Then, those independent variables that had p<0.25 were made a candidate for multivariate logistic regression. After running multivariate logistic regression, we identified as length of stay≥21 days [OR 6.53(1.02-41.9), 95%CI, P=0.048], position change [OR3.94(1.05-14.8),

95%CI, P=0.043], sedation [OR 5.07(1.32-19.51), 95%CI, P=0.018], vasopressor [OR5.06 (1.29-19.92), 95% CI, P=0.02], and friction problem [OR6.32(1.1-36.37), 95% CI, p=0.039] had significant association with pressure ulcer.

Table 5: Association between some selected variables and pressure ulcer at JMC ICU, Ethiopia (n=136)

Variables	Pressure ulcer		COR(95%CI)	AOR(95%CI)
	YES	NO		
Moisture				
Constantly moist	10(26.3%)	28(73.7%)	5.71(1.15-28.3)**	
Very moist	6(17.6%)	28(82.4%)	3.43(.64-18.37)*	
Occasionally	4(13.3%)	26(86.7%)	2.46(.417-14.52)	
Rarely moist	2(5.9%)	32(94.1%)	1	
Nutrition				
Very poor	11(28.9%)	27(71.1%)	6.11(1.24-30.08)**	
Probablyinadequate	5(16.7%)	25(83.3%)	3.00(.54-16.8)*	
Adequate	4(11.1%)	32(88.9%)	1.88(.32-10.99)	
Excellent	2(6.2%)	30(93.8%)	1	
Friction				
Problem	15(39.5%)	23(60.5%)	12.17(3.22-46.1)**	6.32(1.1-36.37)**
Potential problem	4(10.3%)	35(89.7%)	2.13(.45-10.11)	1.58(.24-10.57)
No apparentproblem	3(5.1%)	56(94.9%)	1	
Mechanical ventilation				
YES	19(23.2%)	63(76.8%)	5.13(1.44-18.3)**	
NO	3(5.6%)	51(94.4%)	1	
Length of stay				
≤6 days	2 (3.7%)	52(96.3%)	1	2.43(.29-20.69)
7-20 days	6 (23.1%)	20(76.9%)	7.8(1.45-41.91)**	6.53(1.02-41.9)**
≥21 days	14 (25%)	42(75%)	8.67(1.87-40.28)**	
Position change				
Yes	5(5.6%)	84(94.4%)	1	
No	17(36.2%)	30(63.8%)	9.5(3.23-28.1)**	3.94(1.05-14.8)**
Sedation				
Yes	17(41.5%)	24(58.5%)	12.75(4.27-8.1)**	5.07(1.32-
No	5(5.3%)	90(94.7%)	1	19.51)**
Vasopressors				
Yes	13(38.2%)	21(61.8%)	6.4(2.42-16.9)**	5.06(1.29-
No	9(8.8%)	93(91.2%)	1	19.92)**

** P-value ≤ 0.05, * p-value ≤ 0.25 in binary logistic regression

COR crude odd ratio, AOR adjusted odd ratio

CHAPTER SIX: - DISCUSSION

This study aimed to determine the incidence and associated factors of pressure ulcers in patients who were admitted to the adult intensive care units at Jimma Medical Center. In this study, the overall incidence of pressure ulcers was 16.2%, a higher result than the studies in Spain (8.1%). Jimma (9.6%), Netherlands (3.3%), Tunisia (5.3%)(28,29,36,37).The higher incidence in this study could be due to inadequate care, the lack of an adequate prevention strategy, the lack of a risk assessment tool, the lack of guidelines for the prevention and management of pressure ulcers.

The incidence was also lower than studies in Indonesia (33.3%)(19), Palestine(33%)(32), Iran(25.6%)(33).The discrepancy could be due to a different study design, sample size, participant characteristics, and patient illness.

The incidence of PU was the same with studies comparable in Belgium(16.2%)(26) and with studies conducted in Bahir dar(16.8%)(16). This might be due to similarity of study design and patient characteristics

Of the total of 22 (16.2%) developed pressure ulcers, 27.3% were stage I, 50% stage II, 4.5% stage III, 9.1% stage I and II, 9.1% Stage II and III. The Study conducted at Bahir Dar reported that of the patients who developed pressure ulcers, 62% were stage I, 8.4% Stage III, and 2.8% Stage IV, which was higher than the current study, and stage II was 26,8%, which was lower than the current study(16).

Study results from Nigerian hospital reveals were stage I and II were 8.3% and 20.8% respectively which was lower than the current finding. But stage III and IV were 37.5% and 33.5% which were higher than the current study result(1).

According to the current findings, pressure ulcers were identified at different anatomical locations of the patients; Of the total number of patients who developed pressure ulcers, most 36.4% (8) were found in the sacral region, followed by the greater trochanter 6 (27.3%). This finding is consistent with a study from southwest Ethiopia which showed that 43.7% of PU developed in the sacral area(37). This is because the sacral area is a weight-bearing area for a person lying or sitting down. In addition, the sacral area is exposed to moisture due to incontinence and leakage of the wound from the surgical site.

In this study, a statistically significant relationship between PU and friction and shear was obtained that is similar to previous reports from Desse and the USA(38,39). Patients with

friction/shear problems were 6.32 times more likely to develop pressure ulcers than those with no apparent friction/shear problems. The possible reason is that the friction and shear problem is severely tearing the skin. Shear forces, layers of tissue slide over one another, blood vessels stretch and twist, the microcirculation of the skin and subcutaneous tissue is disrupted(3).

Patients who were hospitalized for $\geq$ 21 days were 6.53 times more likely to develop pressure ulcers in this study than those who stayed $\leq$ 6 days. This finding is in line with studies carried out in Norway and China(35,40)**.** The possible reason for the association between length of stay in hospital and occurrence of PU is that patients may not get appropriate nursing care and adequate nutrition and they deteriorate with the concomitant disease. When patients stay in the hospital for long periods, they are exposed to hospital-acquired infections and are prone to developing pressure ulcers(41).

The patient's change in position was also the other independent variable that was significantly associated with PU. A similar study was conducted in Iran, which found that the occurrence of pressure ulcers was associated with the lack of a change in the patient's position by the nursing staff(42). These patients who have not changed their position were 3.94 times more likely to develop PU than those who have changed their position. The possible cause could be an increase in interfacial pressure in the risk area, which leads to loss of muscle mass, changes the integrity of the tissues, and compromises the adequate blood supply to the risk area because the blood supply to the risk area is not improved because of the patient's position and a lack of awareness by caregivers on turning patients regularly every two hours(43).

In this study, the use of sedatives was statistically significant with the development of pressure ulcers. A patient who uses sedatives was 5.07 more likely to develop pressure ulcers than those without sedatives. This result is in line with the study carried out in Turkey and Spain(44,45). The possible reason could be that the use of sedatives reduces the patient's ability to move spontaneously and/or request a change of position, is not aware of the painful stimuli of strong pressure, and therefore it has been documented that sedated patients develop severe ulcers(46).

The odds of developing PU among patients who were on vasopressor were 5.06 times more likely than those without vasopressor. This finding was comparable with the result of Belgium and America(34,47). This could be due to the nature of a critical illness that often

results in most ICU patients having a circulatory disorder that affects the oxygen supply to body tissues. This problem can be improved with special drugs like norepinephrine, adrenaline, dopamine. These drugs act via the binding to adrenergic receptors, which causes peripheral vasoconstriction, and can further impair the perfusion of peripheral tissue, leading to peripheral cellular hypoxia and ischemia. Therefore, deep peripheral vasoconstriction with noradrenaline administration leads to a reduced local blood flow and an increased risk of developing pressure ulcers(41).

6.1 Limitation of the study

The main limitations of this study were that pressure ulcer was done through cross-sectional rather than longitudinal study, small sample size, and use of a single study site that diminishes the generalizability of the study findings. Due to limitations within the study setup this study did not determine all potential causes of PU. Lack of literature in Ethiopia specifically in ICU makes it difficult to compare results.

CHAPTER SEVEN: - CONCLUSION AND RECOMMENDATION

7.1 Conclusion

The incidence of PU was high among ICU patients. Prolonged length of stay in the hospital, the problem of friction and shearing forces, patient's not change position by nurses, use of vasopressor's and sedatives were significantly associated with the presence of pressure ulcer. Patients who had stayed in the hospital for more than twenty-one days and had a problem with friction and shear were more liable to develop PU. The majority of ulcer-developed patients did not change their position by the nurse frequently.

7.2 Recommendations

Based on the results and findings obtained in this study I would like to recommend the following points to the concerned bodies:

Health professionals: Healthcare providers' particularly nurse's contribution is vital in the prevention of PU for ICU admitted patients by frequent positioning and maintaining head of the bed at lower possible level. Also decreasing depth or duration of sedation, decrease LOS in ICU, and appropriate use of vasopressors are crucial.

Department of anesthesiology: Should consider working on those factors which might have influenced identified risk factors. In addition, the department anesthesiology in collaboration with JMC administrators should work on to establish a better system to early identify risk factors towards the occurrence of PU, training nurses on PU prevention methods, implement different tools like the Braden scale PU risk assessment tool and prepare a guideline on how to handle patients who depeloped PU.

Researchers: The primary outcome of this study was occurance PU, consequently it was not able to report complication of PU like infection, functional disability and quality of life. Therefore, Upcoming studies should determine the long term PU and associated factors which might affect it prospectively. Future studies should also consider interventional studies to find effective and reliable techniques for preventing the initiation of PU and study should be done in multiple center centers for generalization.

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ANNEXES

Annex 1:Information sheet & consent form

Incidence and risk factors of Pressure ulcer patients admitted to ICU of JMC from *August 1 to December 31, 2021*, at, Jimma town, Ethiopia.

Introduction: Good day! I am _____ from JUMC and working with investigator **Gemechis Zerihun (MD)** who is doing his Thesis for partial fulfillment of the requirement for a specialty certificate in anesthesiology. I kindly request you to lend me your attention to explain the issue raised here below.

Purpose: The study will be, helpful to assess Incidence and risk factors of Pressure ulcer patients admitted to ICU from August 10 to December 10, 2021. The Information collected during this study could be used by the MOH, JUMC, organizations supporting the services, and researchers, for planning health service improvement or for conducting further studies on quality health services. Furthermore, the main aim of this study is to write a thesis as a partial requirement for the fulfillment of a specialty certificate in anesthesiology.

Procedure, risk, and duration: First of all the patient was selected to take part in this study because of convenience. There are some questions to be filled on the questioner by checking on the patient card, daily ICU follow-up chart, ICU logbook, and patient's legal guardian. The data will be collected starting on the day of admission until the patient outcome from the ICU is known. The risks of being participated in this study are very minimal, only taking few minutes from your day. Other than this, the study will not cause any physical harm to anybody or the organization. **Confidentiality**: The information provided will be confidential. There will be no evidence that will identify you. The findings of the study will be general for the study population and will not reflect anything particular of the individual person. The questioner will be coded to exclude showing names; no references will be made on reports that could link participants to the research.

Risks and discomforts: No subject is obliged to take part in this study and you may withdraw from the study any time you want

Would you be willing to participate in the study?

Agree_____Disagree _____Signature of the data collector:_____

Informed consent form of Afaan Oromo version

Walii galitee

Ani Obboo/addee/Dr _____ , miseensa garee qorannoo irra.

Qoranoo kun kan inni irratti xiyeefatee, waa'eeyaalamtotakutaanamoota gar maleedhibamaniitticiisanikessayaalamanirratti.

kanaafuu qorannoo kana irrattii wantaisin irraa eegamu akka nuufgotan kabajaan isin gaafanna. Kunis ammoo fayyaayaalamtota garmalee dhukkubsatan irratti fayidaa fi jijjiirama guddaa ni fida.

Waliigaltee fi eyyama kessaniin malee iccitii kessan nama biraaf yookin ammoo waajira tokkoofuu akkadabarsinee hinkenninee waadaa isiniif galla.

Yoo qorannoo kana irratti hirmachuu kessanwaliigallee, gaaffii waliigalaa irraa isiniif jaliqabna. Deebii kessan kan dhugaa irratti hundahee yookennitanfayidaajijjiirama fayyaatif nuf gargaara.

Qorannoon kun karaa univarsitii Jimma irraa fudhatama argatee jira. Kanafuu qorannookanarratti hirmaachuuf fedhii qabduu?

1. nanqaba ……. Deebiin nanqaba yoo jette gaafii itti anutti fufi.

2. Hinqabu …… deebiin hinqabu yoo jette , galatomaa jedhiiti gaafii addaan kuti.

Fedhii qorannoo adeemsisuuf yaada namarraa kan fuudhu.

Maqaa_____

guyyaa gaaffii itti gaafatame ……/…../..... mallattoo……………….

Hordofa isaatin mirkana'u kanmuli'isu

Maqaa……………………guyyaa……../……./……mallattoo……………

የመጠይቅፈቃድ

ጄማዩኒቨርሲቲጤናሳይንስኮሌጅ፤ህክምናትምህርትቤት፤የአንስቴዥሎጂትምህርትክፍል

የመጠይቅፈቃኝነትቅጽ

ስሜ_____ይባላል፡፡እኔበጄማዩኒቨርሲቲበአንስቴዥሎጂትምህርትክፍ
ልየምርምርቡድንዉስጥአንድአባልነኝ፡፡የዚህመጠይቅአላማ.

የጽኑህሙማንክፍልታካሚዎችውጤትእናተያያዥነገሮችንለማወቅለሚደረገውምርምር/ጥናት /መረጃለመሰብሰብነው፡፡
እርስዎአንድየተናቴክፍልአድርጌስመርጥአስፈላጊየሆኑመረጃዎችንእንደሚሰጡኝበማሰብነው፡፡በጥቱለመሳተፍፈቃደኝክ
ሆነክእርስዎየሚገኙዉማንኛውምመረጃበሚስጥርይጠበቃል፡፡ለዚህምሲባልእርስዎሥምእናአድራሻአይገለጽም፡፡እንዲሁ
ምክተናቱበኃላምጽኑሁሙማንክፍልታካሚዎችውጤትእናተያያዥምክንያቶችንለማዎቅእናተገቢየሆኑእርምጃዎንለመወሰድ
ይረዳል፡፡

የቃልሥምምነት

የዚህጥናትዓላማውገብቶኝበጥናቱለመሳተፍ

ሀ. ፈቃደኛሆኛለሁ

ለ. ፈቃደኛአይደለሁም

በጥናቱለመሳተፍፈቃደኛከሆኑቃለመጠይቁንመቀጠልይቻላል፡፡

ፈቃደኛከሆኑየመጠይቁመለያቁጥር _____   መጠይቁየተካሄደበትቀን _____

የጠያቂውስምና ፈርጣ _____

የሱፐርቫይዘርስምናፈርጣ _____

ጥናቱንበተመለከተማንኛዉምአይነትጥያቄካላችሁየሚከተለዉንአድራሻተጠቀሙ፡፡

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Annex 2: Questionnaire

 Part one: sociodemographic characteristics

Questioner Code---------------------

1.   Age in years…………

2.   Sex of the patient

  A. Male   B. Female

3.   Marital status?

A.   Single

B.   married

C.   divorced

D.   other

4.   Religion?

A.   Catholic

B.   Muslim

C.   Orthodox

D.   Protestant

E.   Others

5.   Place of residence of the patient?

A.   Urban   B. Rural

6.   Level education

A.   Can not read and write

B.   Primary school

C.   Secondary school

D.   Higher Education

E.   Other

Part two- clinical data of the patient at the time of admission

7.   Where did the patient stay just prior to admission to the ICU?

A.   Emergency department of the hospital

B.   Hospitals ward

C.   Operating Theatre

D.   Other hospitals

E.   Other(specify)------

8.   Which ward/department of the hospital admitted the patient to the ICU?

A.   General surgery

B.   Internal medicine

C.   Obstetrics and gynecology

D.   Orthopedics

E.   Emergency department

F.   Neurosurgery

G.   Other(specify)--------------

9.   To which ICU patient is admitted

A.   SICU   B. MICU

10.   Prior to ICU admission of the patient, does the patient had any identified co-morbidities apart from reason of admission?

A.   Yes

B.   No

11.   If the answer yes for the above question , specify the co-morbidities

A.   Cardiovascular disease

B.   Respiratory disease

C.   Neurologic disease

D.   Endocrine disease

E.   Infectious disease

F.   Renal disorders

G.   Gastrointestinal diseases

H.   Malignancy

I.   Hematology

J.   Other(specify)_____

12.   What is the GCS of the patient at arrival for admission to ICU?

A.   >= 13

B.   9- 12

C.   <= 8

13.   Does the patient had a history of smoking cigarettes?

A.   Yes   B. No

14.   If question no 13 is yes

A.   Current smoker

B.   Previous smoker

C.   Never smoked

Part three: Braden scale risk assessment

1. Sensory perception

   1. Completely limited   2. Very limited   3.Slightly limited   4.No impairment

19. Moisture

  1. Constantly moist   2. Very moist   3.Occasionally 4. Rarely moist

20. Activity

1. Bed fast   2. Chair fast   3. Walks occasionally   4. Walks frequently

21. Immobility

    1. Completely immobile   2. Very limited   3.Slightly limited   4. No limitation

22. Nutrition

1. Very poor   2. Probably inadequate   3.Adequate   4. Excellent

23. Friction/shear

    1. Problem   2. Potential problem   3. No apparent problem

24. Total Braden scale_____

Part four: Patient pattern of care and clinical characteristics during ICU stay

25. After the patient was admitted to the ICU, was the patient put on a mechanical ventilator anytime during his/her ICU stay?

    A. Yes

    B. No

26. Length of stay in the ICU

A. ≤6 days

B. 7-20 days

        C. ≥21 days

27. Frequent position change was done in ICU

A. Every 2 to 3 hours

B. Every 4 hours

C. 4 times per day

28. Nutritional status

    A. NPO

    B. Diet

29. Hemoglobin level during ICU stay _____ mg/dl

30. Frequent bed sheet changed per day

A. Once

B. Two to three times

31. Did the patient were on sedation during ICU stay?

A. Yes   B. No

32. Did the patient were treated by vasopressors during ICU stay?

A. Yes   B. No

PART V: For those who developed a Pressure ulcer

33**.** Pressure ulcer present?

          A. Yes   B. No

34. Anatomic location of the Pressure ulcer, if > 1 site involved mark all of affected area

 A. Sacral   B. Occipital   C. Greater Trochanter

D.Elbow   E. Heel   F. Ear

G. another site (specify) ----------------------------

45. Grade of the bedsore

A. Grade I   B. Grade II   C. Grade III   D. Grade IV

E. unstageable   F. Other

Annex 3: Declaration sheet

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Institute of health faculty of medical science in effect at the time of grant is forwarded as the result of this application

Name of the student: _____Signature _____

Date: _____

Approval of the first advisor

Name of First Advisor:
_____Signature_____

Date: _____

Name of Second advisor: _____
Signature_____

Date: _____