ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE
DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE MEDICINE AND PAIN MEDICINE

PREVALENCE AND ASSOCIATED FACTORS WITH THE DEVELOPMENT OF PRESSURE ULCER IN ADULT INTENSIVE CARE AND HIGH DEPENDENCY UNIT AT SAINT PAUL`S HOSPITAL MILLENIUM MEDICAL COLLEGE

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Submission Guide

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List of acronyms

ETB:	Ethiopian Birr
G.C:	Gregorian calendar
IQR:	Inter Quartile Range
IRB:	Institutional Review Board
PI:	Principal Investigator
SPHMMC:	Saint Paul Hospital Millennium Medical College
SPSS:	Statistical Package for Social Sciences version 27
USA:	United States of America
WHO:	World Health Organization

Abstract

Background: Pressure ulcer is a localized area of damage to the skin and/or underlying tissue, usually over a bony prominence, resulting from sustained pressure or pressure in combination with shear, as defined by the European Pressure Ulcer Advisory Panel (EPUAP). It is a largely preventable but serious health problem in both acute and chronic healthcare settings. Pressure ulcers impose a significant burden on patients, caregivers, and healthcare systems by increasing morbidity, mortality, length of hospital stay, and healthcare costs. Although pressure ulcer development is considered an indicator of quality of care, concerns remain regarding circumstances in which they may be unavoidable. Understanding the magnitude of the problem and identifying associated risk factors are essential for effective prevention.

Objective: the prevalence and associated risk factors for the development of pressure ulcers at critical care settings (intensive care units and high dependency units) of Saint Paul's Hospital Millennium Medical College was assessed.

Methods: An institution-based cross-sectional study was conducted at Saint Paul's Hospital Millennium Medical College from September 2025 to January 2026. Data was collected using an interviewer-administered structured questionnaire and observational checklist. Data has been entered into and analyzed using appropriate statistical software. Binary logistic regression analysis was performed to identify factors associated with pressure ulcer development. Variables with a p-value ≤ 0.25 in the bi-variable analysis were entered into multivariate logistic regression. Variables with a p-value < 0.05 at a 95% confidence interval is considered statistically significant. The Findings are presented using text, tables, and graphs.

Results: The prevalence of pressure ulcers was 12.5% (28/224; 95% CI: 8.5–17.6%), with the sacra l area being the most commonly affected site (10.3%). Grade 1 ulcers were most frequent (6.3%). Independent predictors of pressure ulcer development included smoking (AOR = 202.96, 95% CI: 4.70–8764.32, p = 0.006), incontinence (AOR = 0.001, 95% CI: 0.000–0.22, p = 0.012), repositioning every 4 hours compared to every 2 hours (AOR = 110.29, 95% CI: 3.14–3874.07, p = 0.010), impaired level of consciousness (AOR = 0.27, 95% CI: 0.12–0.61, p = 0.002), and longer hospital stay (AOR = 2.67 per day, 95% CI: 1.61–4.43, p < 0.001). Age, BMI, sex, and Branden risk levels showed marginal associations but were not statistically significant after adjustment. The multivariate model showed excellent fit (Hosmer-Lemeshow $\chi^2 = 0.721$, Df = 8, p = 0.999) and classified 96.9% of cases correctly.

Conclusion: Pressure ulcers remain a significant concern among hospitalized patients at Saint Paul's Hospital. Major risk factors included smoking, incontinence, less frequent repositioning, impaired consciousness, and prolonged hospitalization. Preventive strategies, including early risk assessment, frequent repositioning, and careful monitoring of high-risk patients, are essential to reduce the burden of pressure ulcers in hospital settings.

Keywords: Pressure ulcer, prevalence, risk factors, cross-sectional study, quality of care

1. Introduction

1.1. Background

Pressure ulcer or hospital - acquired pressure wounds, are defined as a localized skin or underlying tissue damage caused by excessive pressure (1). Decubitus ulcers, also known as bedsores, are localized skin lesions that occur when soft tissue in the prominent bony areas becomes vulnerable to excessive pressure or friction to the external surfaces for a prolonged period of time(2, 3) . Most frequently, pressure ulcers are caused by pressure exerted for an excessive period of time. It can result from friction at the skin surface, shearing forces, moisture, impaired level of consciousness, and immobility. Those patients impaired level of consciousness tend to develop pressure ulcer more frequently than other patients as may not be aware of the discomfort and do not change their position frequently to relieve the pressure (4).

According to the international NPUAP – EPUAP, pressure ulcer can be classified into four stages in which stage-I is characterized by intact skin with non-blanch able redness of a localized area usually over a bony prominence while stage-II has a feature of partial thickness loss of dermis presenting as a shallow open ulcer with a pink wound bed, without slough. On the other hand, Stage III pressure ulcer is a full thickness tissue loss in which subcutaneous fat may be visible, but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. And stage-IV ulcer is a full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed(5).

Pressure ulcers can lead to several serious complications, some of which may be life-threatening. It can cause bacterial infection especially when the stage if higher in which the intactness of the skin is impaired(6). Infected pressure ulcers can progress to sepsis that can result in organ failure, necessitating emergency intervention. Furthermore, pressure ulcer can cause ischemia, cell death, and tissue necrosis, as capillaries are compressed and the blood flow is restricted(7, 8).

Prevalence of pressure ulcers can range anywhere from 0% to 38% depending on level of care (9). In the current study area, there are so many patients requiring prolonged bed rest_which is the common risk factor for developing pressure ulcers. So, there might be a significant number of patients with bedsores. Those are the reasons for conducting research on the prevalence and

associated risk factors of pressure ulcer at ST. PAUL hospital that could be important to prevent pressure ulcer and associated complications.

1.2 Statement of the problem

Pressure ulcer is a localized damage to the skin and underlying tissue resulting from prolonged pressure or pressure combined with shear. Pressure ulcer is one of the significant healthcare problems worldwide. PU remains significant cause of morbidity, mortality, prolonged hospital stays, increased risk of infection and increased health care costs. Particularly patients in critical settings are at increased risk for PU because of factors such as immobility, sedation, hemodynamic instability, malnutrition, chronic co morbid condition and mechanical ventilation s. Despite being largely preventable Several studies worldwide revealed that the magnitude of PU is significantly high indicating a need for better risk assessment, early identification and implementation of evidence – based prevention strategy.

The treatment of patients with pressure ulcers is a major concern and an important wound healing challenge to health care providers working in health care settings. It is related to high morbidity and mortality; especially in frail elderly people with 50% develop severe pressure damage dying within 4 months(10). It is also commonly associated with physical, psychological, and social consequences. If not treated early, PU can result in sepsis, cellulitis, bone and joint infections which can subsequently cause pain and discomfort

Patients with PU have substantially a reduced quality of life which is basically due to pain and limitations on their daily activities(11). PU has also a significant impact on the social well-being of the patients in which patients with PU are burdened with higher healthcare costs. For instance, a study in Dutch indicated that about 450 million euros per year is expended for pressure ulcer associated treatments(5). It is estimated that the cost for the treatment of pressure ulcer is 2.5 times greater than that of prevention.

It is estimated that pressure ulcers occur in 3%–34% of hospitalized patients worldwide, which remains a major health problem affecting approximately 3 million adults(4, 7) . The most frequently affected site with PU were sacrum, heels and hip(12). Another study done in Sweden

revealed that the 21 different countries prevalence ranged from 9 to 31%(13). The prevalence of PU Norwegian and Irish was found to be 54% and 12% respectively(14).

In Africa, the prevalence of PU among hospitalized patients was estimated to be 11% in which grade-I and grade-II occurs in 5% of cases(15). In Ethiopia, the pooled prevalence of PU in a meta-analytic was found to be 11.7% in which 40.89% developed stage I, 32.11% stage II, 11.47% stage III, and 4.31% stage IV PU(16). Another study conducted in Ethiopia indicated 16.8% of admitted patients developed pressure ulcer

Multiple factors are associated with the development of PU, including immobility, age, poor nutritional status, chronic diseases (diabetes, renal diseases, stroke), moisture exposure, however in most healthcare settings specially in developing countries the exact burden and con-tributary risk factors remain under-researched. People over 70 years old are particularly sensitive to pressure ulcers since they are more likely to have mobility issues and age related skin problems(8).

There are several studies regarding PU globally and locally, however; there is inconsistencies and limitations across the findings that warrant further studies and despite being largely preventable Several studies worldwide revealed that the magnitude of PU is significantly high indicating a need for better risk assessment, early identification and implementation of evidence – based prevention strategy. Furthermore, there is limited finding in the current study area regarding pressure ulcer in which the possible factors associated with the development of pressure ulcer among patients admitted to ST. PAUL hospital needs to be identified that can have an important part on the prevention of pressure ulcer and its possible complications. Therefore, the aim of this study is to determine prevalence and factors associated with pressure ulcer at ST. PAUL Hospital.

1.3 Rational of the study

Pressure ulcers remain a significant and complex health problem in hospitals in terms of human suffering, tissue necrosis, pain, septicemia, disfigurement, loss of productivity, financial burden, and increased mortality(17). Despite being largely preventable the magnitude of PU is significantly high and causes increased morbidity, mortality and health care cost, indicating a need for better risk assessment, early identification and implementation of evidence – based prevention strategy. So, knowing the associated risk factor for the development of pressure ulcer plays pivotal role for the prevention of pressure ulcer. As well as knowing the prevalence of pressure ulcers will lead to the stake holders (health care providers, nursing educators, health service managers and researchers) giving attention for the prevention for improving patient outcome and quality of life.

For health service managers, it enables them to identify the barriers of care to prevent pressure ulcers and minimize these perceived barriers as much as possible. For nurse educators and all healthcare providers at large, it allows them to consider more evidence related contents regarding pressure ulcer prevention to their students. Researchers can take the findings of this study as an input for further investigations. Furthermore, the findings of this study can be used as a baseline to develop guidelines on pressure ulcer prevention for admitted patients for policy makers.

2. Literature Review

Pressure ulcers have been identified as a major burden of hospitalization worldwide, and nurses

are at the forefront of prevention (18).Pressure ulcers increase the cost of hospitalization, increase patient morbidity and mortality, and play a significant role in the spread of infection in the clinical area(19). The presence or absence of pressure ulcers has been generally regarded as a performance measure of quality care and overall patient health.

2.1 Prevalence of PU

Prevalence of pressure ulcers varies across different findings which may depend on the setting, the level of care provided or the patient characteristics including age and other clinical conditions. Global incidence of pressure ulcer was found to be 14.8% according a meta-analytic study and another systematic and meta-analytic study in Ethiopia indicated that the overall prevalence of PU was found to be 11.7%(10, 20).

There are multiple studies worldwide showing the prevalence of pressure ulcers among hospitalized patients that show there is a substantial difference in its magnitude. Studies in Sweden, Norway, Brazil, China, Turkey, Nigeria, Tunisia, Felege hi-wot referral hospital, Wolaita Sodo, and Hawassa indicated that the prevalence of PU was 14.9%, 18.2%, 10.1%, 1.58%, 3.22%, 19.3%, 16.8%, 13.4%, and 8.3%(5, 21-28).

2.2 Factors associated with pressure ulcer

There have been multiple factors that contribute to the development of pressure ulcers in different settings. Although those factors had been classified into different categories by different studies, this study tried to classify the factors into three distinct categories by reviewing several literature s. These include socio-demographic, clinical related and behavioral characteristics of the patients.

2.2.1 Socio-demographic factors

There are several demographic characteristics of patients that had been found to have a significant association with pressure ulcer among hospitalized patients. From those variables, age is one of the factor that showed a significant association based on a meta-analytic study conducted globally(12). A study carried out in Italy(29), ARBA MINCH and JINKA Hospitals(30) indicated that age was one of the risk factors for the development of pressure ulcer among hospitalized

patients.

Gender was also identified as one of the factors that had a statistically significant relation with PU but there was inconsistency among different studies. Based on the finding of the study conducted in Home Healthcare Unit of Ataturk Training and Research Hospital(29) and Italy(31) female patients had a higher tendency of developing pressure ulcer when compared to male patients.

BMI is another important factor that showed a significant association with PU in different findings. For instance, the finding of the study conducted in Sid-amma region of Ethiopia found that the association between BMI and the risk of PU is complex in which certain studies found that the risk increases with decreasing BMI while others reported that it increases directly as BMI increase(32). But most of other studies showed the relation with BMI is bimodal. For instance, based on the findings of certain studies, patients with BMI of less than 18.5kg/m^2 had a higher tendency to develop PU as compared to those with a range of 25-29.99kg/m^2(33-35).

There have not been findings that indicated the significant association between the educational qualification of patients and the likelihood of pressure ulcers. This suggests that patients are at risk of getting pressure ulcers regardless of their educational status. But certain studies narrated that higher level of educational level enhances patients to be engaged in preventive practices that reduces the chance of developing pressure ulcers(36).

2.2.2 Clinical factors

Chronic comorbidities such as cardiovascular disease, diabetes, chronic pulmonary disease, and renal disorders have been found to be strongly associated with PU. Based on the findings of the studies conducted in Norway(37), University of Victoria(38), Kenya(39), and Wolaita (Ethiopia)(5), those patients with multiple chronic comorbidity were at higher risk of getting PU.

Mobility issues or level of activity and nutritional status are another significant variable that can potentially lead patients to develop pressure ulcers. Studies in Kenya(39), Dessie(22), Sidama (35), Wolaita (9) indicated that patients with impaired mobility or being bed bound had a greater tendency to develop pressure ulcer. Similarly studies carried out in Spain(40), Bozyaka Training and Research Hospital Home Health Service(41), Kenya(39), and Dessie(22) indicated that nutritional status was one of a significant variable in which patients who were malnourished has a greater chance of getting pressure ulcer as compared to well-nourished ones.

Incontinence was also one of the factors identified as having a significant association with the development of pressure ulcers among hospitalized and critically ill patients. According to the findings of the studies done in India (42) and Kenya (39) showed that patients with fecal incontinence had a higher risk of getting pressure ulcer.

Length of hospital stay was also one of the variables that had a significant association with PU. Studies conducted in Spain(40), Saudi Arabia (43), Turkey (44), Dessie(22), and Wolaita Sodo showed that length of hospital stay had a significant association with PU in which patients who stayed for a prolonged period of time were at pronounced risk for developing pressure ulcer as compared to the contrary groups.

Furthermore, sedation, frequency of position change, Brad-en scores, mechanical ventilation, level of consciousness, friction or shear and type of admission (from the emergency room, scheduled surgery operating room or hospital ward) were also identified as clinical related variables that showed a significant relation with pressure ulcer. Patients who were sedated, having lower Brad-en scores, being on mechanical ventilation, impaired level of consciousness, having friction or shear, and being admitted from emergency room had a greater tendency of getting pressure ulcer as compared to the contrary(5, 29, 37-39).

2.2.3 Behavioral factors

There are several behavioral factors associated with the likelihood of having pressure ulcers among hospitalized patients. Among the several behavioral variables ; A study conducted in adult critical care unit patients indicated that smokers had a significantly higher incidence of pressure ulcers than non-smokers(13). However, there has not been adequate findings that showed whether there is a significant association between pressure ulcers with previous chat chewing and excessive alcohol consumption history among hospitalized patients.

Overall, the prevalence of pressure ulcers is significant public health problems associated with significant morbidity, mortality, health care cost and burden of hospitals and health care facilities. The resource needed for prevention of PU is much lower than the resource needed for treatment. So, knowing the associated risk factors of pressure ulcer is the pillar for the prevention. overall the commonest identified risk factors of pressure ulcers in most literature are prolonged hospital stays, the presence of co morbid illness, bed and chair ridden patients, those patients having sensory

impairment, and those patients having incontinence and malnourished. Ongoing research is necessary to explore innovative preventive strategies.

2.2 Conceptual framework

The conceptual framework shows the possible relationship between pressure ulcer with the socio-demographic, clinical, and behavioral characteristics of patients that was developed after reviewing several previous studies(5, 29, 37-39).

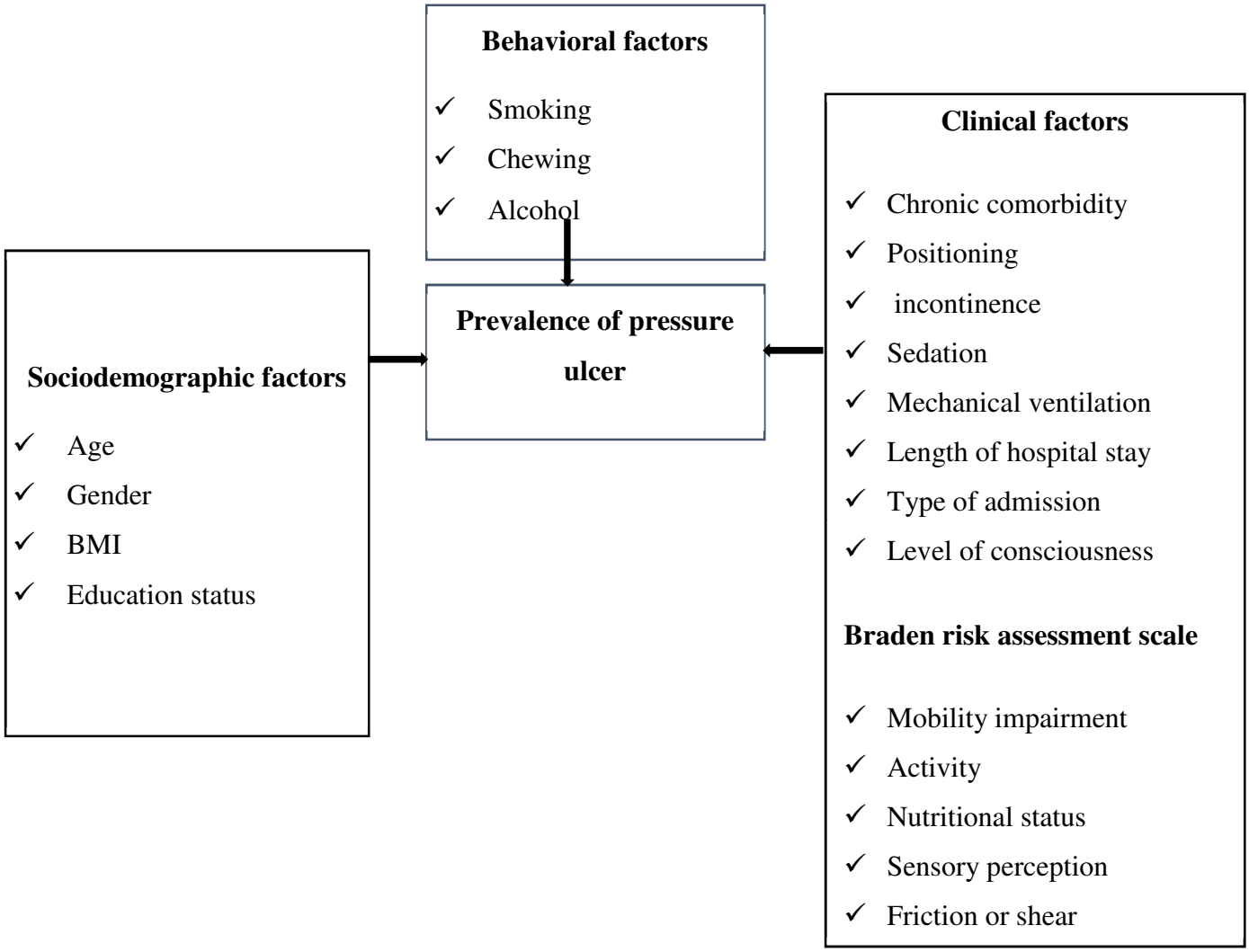

Figure 1: conceptual framework

3.Objectives

3.1 General objectives

- To assess prevalence and associated factors of pressure ulcer at saint PAUL'S Hospital millennium medical college ADDIS ABABA Ethiopia, 2025.

3.2 Specific Objective

- To determine prevalence of pressure ulcer at saint PAUL'S Hospital ADDIS ABABA Ethiopia, 2025.
- To identify factors associated with the development of pressure ulcer at Saint PAUL'S Hospital ADDIS ABABA, Ethiopia, 2025

4. Method and Materials

4.1. Study area and period

Saint Paul's Hospital Millennium Medical College was established in 1968 as a tertiary teaching hospital and was later restructured into a medical college in 2010. The hospital has more than 700 inpatient beds and serves over 1,200 emergency and outpatient clients daily. It operates one central Intensive Care Unit (38) and dedicated High Dependency Units (HDU) for major disciplines, including surgery, obstetrics, and internal medicine.

The institution provides a wide range of surgical services, including general surgery, gynecologic and obstetric surgery, urological surgery, cardio thoracic surgery, and neurosurgery. Currently, the hospital employs more than 2,800 academic, clinical, administrative, and support staff.

The research proposal was finalized in September 2025. Data collection was carried out from September 2025 to January 2026, while data analysis and report writing were completed in February 2026.

The study was conducted at Saint Paul's Hospital Millennium Medical College, specifically in the Intensive Care Units (St. Paul's Main ICU and A abet ICU) and the High Dependency Units (medical, surgical, and obstetric HDU).

4.2. Study design

- An institution-based cross-sectional study was conducted to assess the prevalence and associated factors for the development of pressure ulcers among patients admitted to the Intensive Care Unit (38) and High Dependency Unit (HDU) at Saint Paul's Hospital Millennium Medical College.

4.3. Population

4.3.1. Source population

- All patients admitted to intensive care units (main ICU and A abet ICU) and high dependency units (medical, surgical and obstetric) of saint Paul's hospital millennium medical college during the study period

4.3.2. Study population.

- Patients admitted in ICU and HDU at SPHMMC who fulfill inclusion criteria during the study period

4.4. Eligibility

4.4.1 Inclusion

- All patients admitted to ICU and HDU during the study period
- And those who stayed more than 24 hours.

4.4.2 Exclusion criteria

- patients who have trauma at the site,
- patient who has pressure ulcer at admission,
- patient unwilling to provide consent
- age less than 18.

4.5. Sample size determination and sampling technique

4.5.1 Sample size calculation

The sample size for this study was calculated using the single population proportion formula, based on a prevalence of 16.8% (p = 0.168) reported in a previous study conducted at Felege Hiwot Hospital. The formula used was:

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

Where:

- n= desired sample size
- $Z_{\alpha/2}$= Z-value at 95% confidence level (1.96)
- p= estimated population proportion (0.168)
- d= margin of error (5% or 0.05)

Based on these assumptions, the calculated sample size was 214 patients. To account for a possible non-response rate of 10%, the final sample size was increased to 235 participants.

4.5.2 Sampling technique

A systematic random sampling technique was employed to select the study participants. The total number of patients admitted to the adult Intensive Care Unit (38) and High Dependency Unit (HDU) over the four months preceding the study was 552.

The sampling interval (k) was determined using the formula:

$$k = \frac{N}{n}$$

where *N* represents the total population (552) and *n* represents the calculated sample size. The sampling interval was approximately 2.

The first study participant was selected randomly from the first two admissions, and thereafter, every second patient was selected until the required sample size was achieved.

Since the admission rates to the ICU and HDU over the previous four consecutive months were approximately similar, proportional allocation was applied. Accordingly, an approximately equal number of participants ((42)from each unit) were selected to ensure fair representation of both areas.

4.6. Variables

4.6.1 Dependent

- Prevalence of pressure ulcers

4.6.2. Independent

- Socio-demographic factors: Age, sex, marital status, income, education, residency
- Health service-related factors: length of hospital stay, position change, supportive device use
- Behavioral factors: Smoking status, alcohol use
- Clinical characteristics: comorbidity, level of consciousness, BMI, type of admission, Brad en risk assessment scale

4.9 Operational definition

Pressure ulcer is defined as a localized skin or underlying tissue damage caused by excessive pressure

Braden risk assessment scale; Braden risk assessment tools are the most commonly used prediction tools for identifying patients who has high risk for pressure ulcer and rates patients in six scales which includes; sensory perception, moisture, activity, mobility, nutrition (each scores 1 to 4) and friction & shear (scores 1 to 3) Those patients with a score of <17 regarded as having risk for PU and those with a score of ≥17 will be regarded as having no risk for PU (35, 45)

Braden risk assessment scale

- ✓ low risk (19 to 23
- ✓ Mild risk (15 to 18)
- ✓ Moderate risk (13 to 14)
- ✓ High risk (10 to 12)
- ✓ Severely at risk(<9)

BRADEN SCALE – For Predicting Pressure Sore Risk

SEVERE RISK: Total score ≤ 9 **HIGH RISK**: Total score 10-12
MODERATE RISK: Total score 13-14 **MILD RISK**: Total score 15-18

DATE OF ASSESS ➡

RISK FACTOR	SCORE/DESCRIPTION			
SENSORY PERCEPTION Ability to respond meaningfully to pressure-related discomfort	**1. COMPLETELY LIMITED** – Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation, **OR** limited ability to feel pain over most of body surface.	**2. VERY LIMITED** – Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness, **OR** has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**3. SLIGHTLY LIMITED** – Responds to verbal commands but cannot always communicate discomfort or need to be turned, **OR** has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	4. **NO IMPAIRMENT** – Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.
MOISTURE Degree to which skin is exposed to moisture	1. **CONSTANTLY MOIST**– Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	2. **OFTEN MOIST** – Skin is often but not always moist. Linen must be changed at least once a shift.	3. **OCCASIONALLY MOIST** – Skin is occasionally moist, requiring an extra linen change approximately once a day.	4. **RARELY MOIST** – Skin is usually dry; linen only requires changing at routine intervals.
ACTIVITY Degree of physical activity	1. **BEDFAST** – Confined to bed.	2. **CHAIRFAST** – Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	3. **WALKS OCCASIONALLY** – Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	4. **WALKS FREQUENTLY**– Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.
MOBILITY Ability to change and control body position	1. **COMPLETELY IMMOBILE** – Does not make even slight changes in body or extremity position without assistance.	2. **VERY LIMITED** – Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	3. **SLIGHTLY LIMITED** – Makes frequent though slight changes in body or extremity position independently.	4. **NO LIMITATIONS** – Makes major and frequent changes in position without assistance.
NUTRITION Usual food intake pattern [1]NPO: Nothing by mouth. [2]IV: Intravenously. [3]TPN: Total parenteral nutrition.	**1. VERY POOR** – Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, **OR** is NPO[1] and/or maintained on clear liquids or IV[2] for more than 5 days.	**2. PROBABLY INADEQUATE** – Rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement **OR** receives less than optimum amount of liquid diet or tube feeding.	**3. ADEQUATE** – Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally refuses a meal, but will usually take a supplement if offered, **OR** is on a tube feeding or TPN[3] regimen, which probably meets most of nutritional needs.	4. **EXCELLENT** – Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.
FRICTION AND SHEAR	1. **PROBLEM**- Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	2. **POTENTIAL PROBLEM**– Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	3. **NO APPARENT PROBLEM** – Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.	

4.7 Data Collection Tool and Procedures

The structured questionnaire was developed after reviewing previously published literature relevant to the study topic. The data were collected using an interviewer-administered structured questionnaire and an observational checklist. The questionnaire was adopted and modified from different studies conducted on similar and related topics to fit the context of the present study.

The questionnaire consisted of three main components: socio-demographic characteristics, clinical characteristics (including the Brad en Risk Assessment Scale), and behavioral characteristics of the patients.

The Brad en Risk Assessment Scale comprises six components: sensory perception, activity, mobility, moisture, nutrition, and friction and shear. Each component contains four scoring items, except friction and shear, which has three scoring items. The total score ranges from 6 to 23. Patients with a Brad en score of <17 were categorized as being at risk for pressure ulcer development, whereas those with a score of ≥17 were categorized as not at risk.

The data collection tools were prepared in English. After obtaining written informed consent, data were collected by resident physicians who received prior training on the objectives of the study, data collection procedures, and proper use of the data collection tools to ensure consistency and accuracy.

4.8 Data Quality assurance

To ensure the validity and reliability of the data collection tool, a pretest was conducted on 5% of the total sample size prior to the actual data collection. The questionnaire was assessed for clarity, understandability, and simplicity, and necessary modifications were made accordingly.

During the data collection period, completed questionnaires were carefully reviewed for completeness and consistency on daily basis to ensure data quality. Appropriate corrections were made whenever necessary to maintain the accuracy and reliability of the data

4.9. Data processing and Analysis

After data collection was completed, the data were checked for completeness, cleaned, coded, and entered into a computer using Statistical Package for the Social Sciences (SPSS) version 27 for analysis.

Descriptive statistics were used to summarize the characteristics of the study participants and to estimate the prevalence of pressure ulcer among patients admitted to the High Dependency Unit (HDU) and Intensive Care Unit (38). Binary logistic regression analysis was performed to identify factors associated with the development of pressure ulcer.

Variables identified in the bi-variable analysis were entered into the multivariate logistic regression model to control potential confounders. Adjusted odds ratios (AOR) with 95% confidence intervals (95% CI) were calculated to estimate the strength of association between independent variables and the outcome variables. Statistical significance was declared at a p-value of < 0.05.

4.10. Ethical consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of Saint Paul's Hospital Millennium Medical College prior to the commencement of the study. Participation in the study was entirely voluntary, and written informed consent was obtained from each study participant before data collection.

Participants were informed about the purpose of the study, the procedures involved, potential risks and benefits, and their right to withdraw from the study at any time without any consequences. The privacy of the participants was strictly respected. No personal identifiers were recorded, and all collected data were kept confidential and used solely for research purposes. Confidentiality was maintained throughout the study period and beyond.

4.11. Dissemination and utilization of results

The result of the study will be presented and submitted to department of Anesthesia and critical care, SPHMMC, Public health department. Effort will be made to present the results in scientific conferences, Association meetings and to publish.

5 Result

5.1 Socio-demographic Characteristics of study population

A total of 224 participants were included in the study. The median age was 39 years (inter quartile range: 31–51), with 50 (22.3%) participants aged ≤29 years, 62 (27.7%) aged 30–39 years, 50 (22.3%) aged 40–49 years, 42 (18.8%) aged 50–59 years, and 20 (8.9%) aged ≥60 years. Males accounted for 121 (54.0%) of the study population, while females comprised 103 (46.0%). Regarding residency, 124 (55.4%) participants lived in rural areas, and 100 (44.6%) resided in urban settings. In terms of educational status, 73 (32.6%) participants were unable to read and write, 74 (33.0%) had primary education, 59 (26.3%) had completed secondary education or diploma, and 18 (8.0%) had a degree or higher, indicating a relatively low overall level of formal education among the study population

Table 1 Demographic characteristics patients attending at Saint Paul's Hospital Addis Ababa Ethiopia, 2025.

		Frequency	Percent
Sex	Male	121	54.0
	Female	103	46.0
	Total	224	100.0
Age (Years)	≤ 29	50	22.3
	30–39	62	27.7
	40–49	50	22.3
	50–59	42	18.8
	≥ 60	20	8.9
	Total	224	100.0
Residency	Urban	100	44.6
	Rural	124	55.4
	Total	224	100.0
Educational Status	Unable to read and write	73	32.6
	Primary education	74	33.0
	Secondary to diploma education	59	26.3
	Degree and above	18	8.0
	Total	224	100.0

5.2 Prevalence of Pressure ulcer and Brad-en risk assessment scale

In this study the prevalence of pressure ulcer was found to be 12.5% 28 (95% CI 8.5-17.6%)

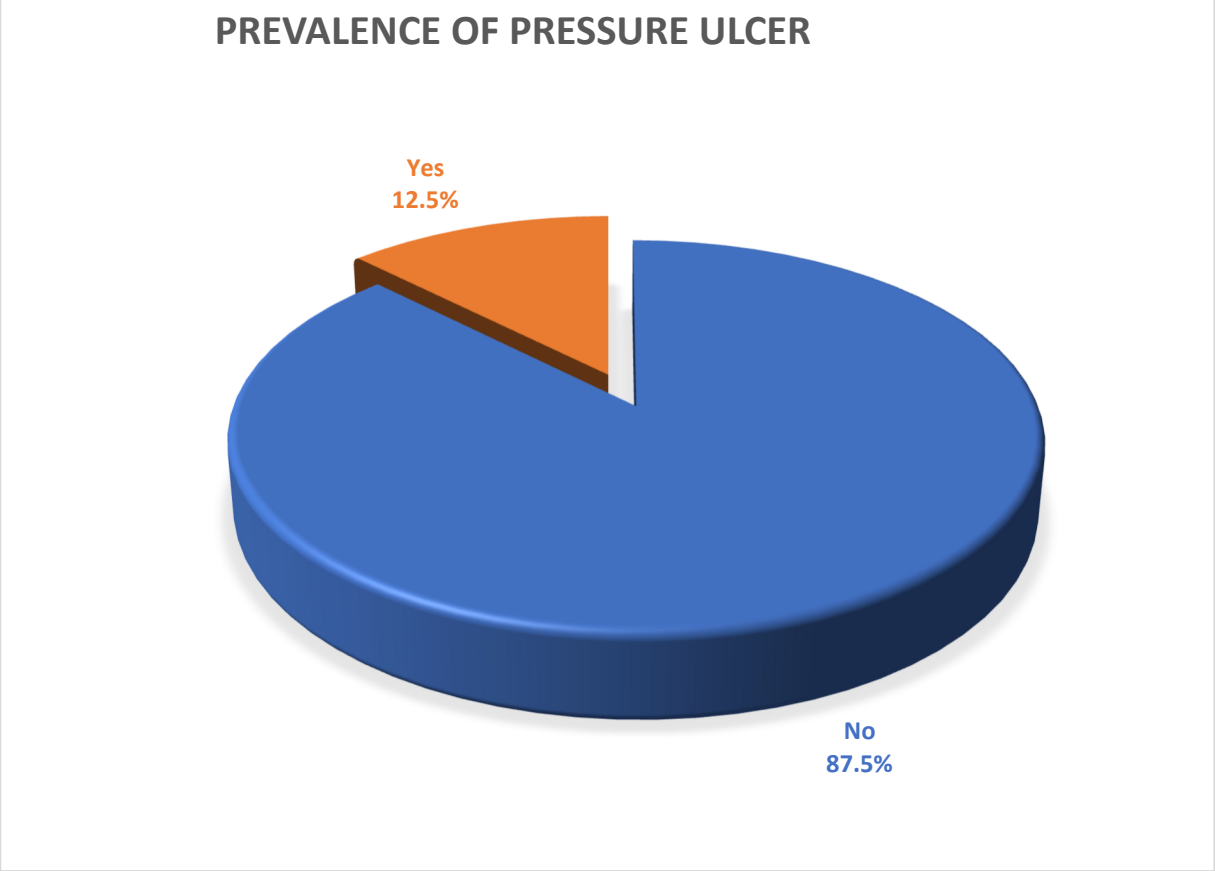

Fig 2 Prevalence of pressure ulcer patients attending at critical care setting of Saint Paul's Hospital ADDIS ABABA Ethiopia, 2025.

Regarding anatomical location, the sacra l area was the most affected site, accounting for 23 cases (10.3%) of the total study population. Pressure ulcers involving the buttock were observed in 4 patients (1.8%), while the lumbosacral area was affected in 1 patient (0.4%).

In terms of severity, Grade 1 pressure ulcers were the most frequent, occurring in 14 patients (6.3%). This was followed by Grade 2 ulcers in 9 patients (4.0%) and Grade 3 ulcers in 5 patients (2.2%)

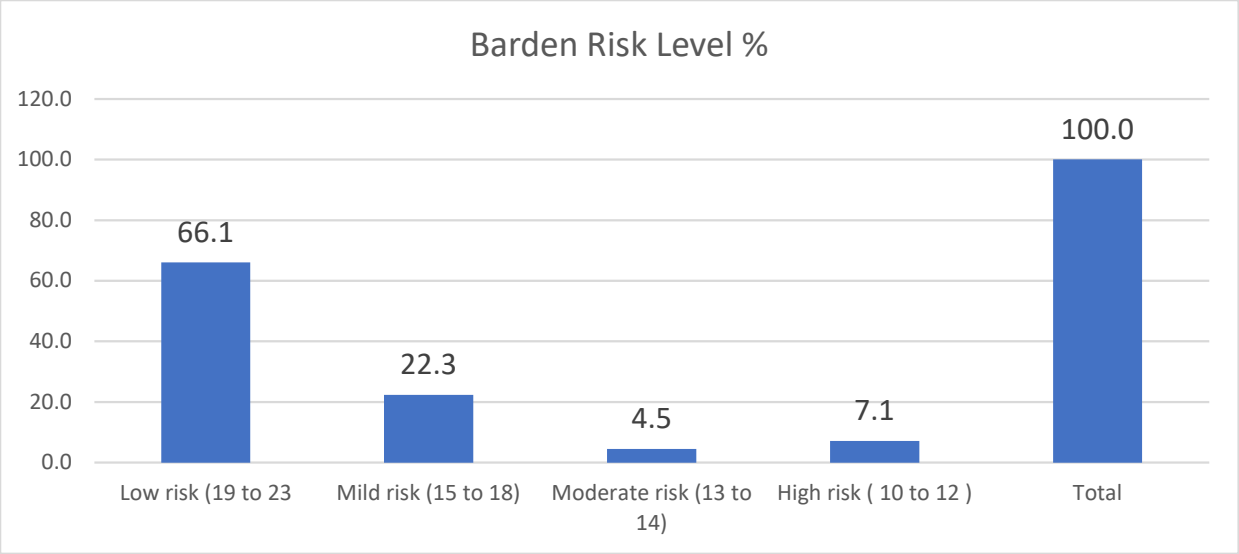

Fig 3 Barden Risk level Saint Paul's Hospital Addis Ababa Ethiopia, 2025.

Regarding Brad-en Score and Pressure Ulcer Risk, The median Brad-en score among the study participants was 20, with an inter quartile range (IQR) of 17 to 21. Based on Brad en risk level classification, 148 (66.1%) participants were categorized as low risk (score 19–23). Participants with mild risk (score 15–18) accounted for 50 (22.3%), while 10 (4.5%) and 16 (7.1%) participants were classified as having moderate risk (score 13–14) and high risk (score 10–12), respectively.

5.3 Clinical characteristics of study population

In this study, the most common reason for admission was post-operative and other surgical conditions, affecting 80 patients (35.7%). Neurological conditions were the second most frequent cause, observed in 40 patients (17.9%), followed by obstetric and pregnancy-related conditions, which accounted for 38 admissions (17.0%). Cardiovascular diseases and respiratory conditions each contributed to 28 cases (12.5%). Infectious and septic conditions were identified in 22 patients (9.8%), while metabolic and endocrine disorders accounted for 12 cases (5.4%).

Table 2 : Diagnosis / Reason for Admission of Patients (n = 224) at Saint Paul's Hospital Addis Ababa Ethiopia, 2025

Diagnosis Category	Frequency (n)	Percent (%)
Post-operative / Surgical conditions	80	35.7
Neurological conditions	40	17.9
Obstetric / Pregnancy-related conditions	38	17
Cardiovascular diseases	28	12.5
Respiratory diseases	28	12.5
Infectious / Septic conditions	22	9.8
Metabolic / Endocrine disorders	12	5.4
Total	**224**	**100**

In this study, most patients had a normal body mass index (BMI), with 147 (65.6%) falling in the 18.5–24.9 range. Overweight patients accounted for 67 (29.9%), underweight for 7 (3.1%), and only 3 patients (1.3%) were obese. Regarding hospital stay, the majority of patients (182, 81.3%) were hospitalized for seven days or less, 24 (10.7%) stayed 8–14 days, and 18 (8.0%) stayed 15 days or more.

Co morbid conditions were present in 90 patients (40.2%), with cardiovascular diseases (35, 33.7%) and other conditions (45, 43.3%) being the most common, followed by diabetes (16, 15.4%), renal disease (6, 5.8%), and stroke (2, 1.9%). Only 2 patients (0.9%) had incontinence, and 47 (21.0%) were sedated. Most patients (174, 77.7%) had a Glasgow Coma Scale score of 13–15, 16 (7.1%) scored 9–12, and 34 (15.2%) scored ≤8. Mechanical ventilation was required in 61 patients (27.2%).

The majority of admissions were from the emergency room (149, 66.5%), while 75 (33.5%) came from elective surgery. Regarding mobility and care, 70 patients (31.3%) could reposition

themselves independently, 99 (44.2%) required assistance from family, and 55 (24.6%) needed full assistance from others. Most patients (149, 66.5%) were repositioned every 2 hours, 46 (20.5%) every 4 hours, 19 (8.5%) four times a day, and 10 (4.5%) less than four times a day. In terms of activity, nearly half of the patients were bed-bound (110, 49.1%), 101 (45.1%) walked occasionally, 10 (4.5%) walked frequently, and 3 (1.3%) were chair-bound.

Table 3: Clinical and Functional Characteristics of Hospitalized Patients (N = 224) at Saint Paul's Hospital Addis Ababa Ethiopia, 2025

		Frequency	Percent
BMI	Underweight (< 18.5)	7	3.1
	Normal weight(18.5 – 24.9)	147	65.6
	Overweight (25.0 – 29.9)	67	29.9
	≥ 30.0 (Obese)	3	1.3
	Total	224	100
Length of Hospital Stay	≤ 7 days	182	81.3
	8–14 days	24	10.7
	≥ 15 days	18	8
	Total	224	100
Presence of co morbid	No	134	59.8
	Yes	90	40.2
	Total	224	100
comorbid illness	Diabetics	16	15.40%
	Stroke	2	1.90%
	Cardiovascular	35	33.70%
	Renal	6	5.80%
	Other	45	43.30%
	Total	104	100.00%
Incontinence	No	222	99.1
	Yes	2	0.9
	Total	224	100
Sedated	No	177	79
	Yes	47	21
	Total	224	100
Level of consciousness	13–15	174	77.7
	9–12	16	7.1

	≤ 8	34	15.2
	Total	224	100
mechanically ventilated	No	163	72.8
	Yes	61	27.2
	Total	224	100
Length of Hospital Stay	≤ 7 days	182	81.3
	8–14 days	24	10.7
	≥ 15 days	18	8
	Total	224	100
Admission	From emergency room	149	66.5
	From operating room after elective surgery	75	33.5
	Total	224	100
Responsible person for changing position	Self	70	31.3
	With assistance with family member	99	44.2
	Completely with others	55	24.6
	Total	224	100
Frequency to change position	Every 2 hours	149	66.5
	Every 4 hours	46	20.5
	4 times in a day	19	8.5
	Less than 4 times per day	10	4.5
	Total	224	100
Activity	Bed bound	110	49.1
	Chair bound	3	1.3
	Walk occasionally	101	45.1
	Walk frequently	10	4.5
	Total	224	100

5.4 Behavioral factors

Regarding alcohol consumption, the majority of study participants 192 (85.7%) reported that they did not drink alcohol, while 32 (14.3%) reported alcohol use. Among those who consumed alcohol, most were classified as moderate drinkers, with 22 (68.8%) reporting alcohol intake on 3–4 days per week. Occasional drinkers (1–2 days per week) and frequent drinkers (≥5 days per week) each accounted for 5 (15.6%) of alcohol users.

With respect to chat chewing, the vast majority of participants 217 (96.9%) reported that they did not chew chat, whereas only 7 (3.1%) participants reported the practice. All chat chewers reported chewing chat on four or more days per week

Table 4. Alcohol Drinking and Chat Chewing Practices of Study Participants (n = 224) at Saint Paul's Hospital Addis Ababa Ethiopia, 2025

		Frequency	Percent
Drink alcohol	No	192	85.7
	Yes	32	14.3
	Total	224	100.0
Alcohol Frequency	Occasional (1–2 days/week)	5	15.6
	Moderate (3–4 days/week)	22	68.8
	Frequent (≥5 days/week)	5	15.6
	Total	32	100.0
chew chat	No	217	96.9
	Yes	7	3.1
	Total	224	100.0
Chat-Chewing Frequency	≥4 days per week	7	100.0

5.5 Factor Associated with Pressure ulcer

5.5.1 Bi-variable Analysis

In this study, a total of 224 patients were assessed for the development of pressure ulcers. Potential risk factors were initially evaluated using bi-variable logistic regression. Variables included smoking, chewing khat, alcohol use, age, gender, BMI, educational status, chronic comorbidities, patient positioning, incontinence, sedation, mechanical ventilation, length of hospital stay, type of admission, level of consciousness, and Brad en risk assessment score. Variables with a p -value

less than 0.25 were considered candidate variables for multivariate analysis. Based on this screening, the candidate variables included smoking, incontinence, Brad en risk level, mechanical ventilation, repositioning frequency, level of consciousness, length of hospital stay, age, BMI, and sex.

5.5.2 Multivariate Logistic Regression and Model Fitness

The selected candidate variables were entered into a multivariate logistic regression model to identify independent predictors of pressure ulcer development. The model was statistically significant (Omnibus test: $\chi^2 = 135.61$, df = 12, $p < 0.001$), indicating that the predictors collectively improved model fit compared to a null model. The Hosmer-Lem show goodness-of-fit test demonstrated excellent fit ($\chi^2 = 0.721$, df = 8, $p = 0.999$). The model explained a substantial portion of variability in pressure ulcer occurrence (Cox & Snell $R^2 = 0.454$, Nagelkerke $R^2 = 0.858$) and correctly classified 96.9% of cases, with 98.5% accuracy for patients without pressure ulcers and 85.7% for those with pressure ulcers.

The multivariate analysis identified several independent predictors of pressure ulcer development. Smoking was associated with significantly higher odds compared to non-smokers (AOR = 202.96, 95% CI: 4.70–8764.32, p = 0.006). Incontinence markedly increased the risk (AOR = 0.001, 95% CI: 0.000–0.22, p = 0.012). Higher Braden risk levels were associated with increased odds, although these did not reach statistical significance after adjustment (mild risk: AOR = 1.61, 95% CI: 0.18–14.16; moderate risk: AOR = 4.08, 95% CI: 0.06–267.76; high risk: AOR = 3.31, 95% CI: 0.10–109.16). Patients who had been on mechanical ventilation had lower odds of developing pressure ulcers (AOR = 0.000, 95% CI: 0.000–0.037, p = 0.003), likely due to close monitoring and preventive care. Repositioning frequency was critical, with patients re positioned every 4 hourly or less having significantly higher odds than those reposition ed every 2 hours (AOR = 110.29, 95% CI: 3.14–3874.07, p = 0.010). Impaired level of consciousness significantly increased risk (AOR = 0.27, 95% CI: 0.12–0.61, p = 0.002), and longer hospital stay was also a strong predictor (AOR = 2.67 per day, 95% CI: 1.61–4.43, p < 0.001). Age and BMI showed marginal associations (AOR = 1.07, 95% CI: 0.99–1.16, p = 0.088; AOR = 1.54, 95% CI: 0.99–2.39, p = 0.055), and male sex showed higher odds than females (AOR = 20.13, 95% CI: 0.88–459.81, p = 0.060), though not statistically significant

Table 5. Multivariate Logistic Regression Analysis of Factors Associated with Pressure Ulcer Development among Hospitalized Patients (N = 224)

Variable	Category	No n (%)	Yes n (%)	Bi-variate Analysis (COR, 95% CI)	Multivariate Analysis (AOR, 95% CI)	P-value
Sex	Female	95 (92.2%)	8 (7.8%)	1	1	–
	Male	101 (83.5%)	20 (16.5%)	0.43 (0.18–1.01)	20.13 (0.88–459.81)	0.06
Smoking	No	189 (90%)	21 (10%)	1	1	–
	Yes	7 (50%)	7 (50%)	9.00 (2.87–28.15)	202.96 (4.70–8764.32)	**0.006**
Incontinence	No	195 (87.8%)	27 (12.2%)	1	1	–
	Yes	1 (50.0%)	1 (50.0%)	7.22 (0.44–118.87)	0.001 (0.000–0.22)	**0.012**
Braden Risk Level	Low risk	142 (95.9%)	6 (4.1%)	1	1	–
	Mild risk	38 (76.0%)	12 (24.0%)	7.47 (2.63–21.22)	1.61 (0.18–14.16)	0.67
	Moderate risk	9 (90.0%)	1 (10.0%)	2.63 (0.29–24.25)	4.08 (0.06–267.76)	0.51
	High risk	7 (43.8%)	9 (56.3%)	30.43 (8.45–109.63)	3.31 (0.10–109.16)	0.502
	No	154 (94.5%)	9 (5.5%)	1	1	–

Mechanical Ventilation	Yes	42 (68.9%)	19 (31.1%)	7.74 (3.27–18.35)	0.000 (0.000–0.037)	**0.003**
Repositioning Frequency	Every 2 hours	143 (96.0%)	6 (4.0%)	1	1	–
	Every 4 hours	53 (70.7%)	22 (29.3%)	9.89 (3.80–25.73)	110.29 (3.14–3874.07)	**0.01**
Age (Years)	Continuous	Median 39 (IQR 31–51)		1.00 (1.00–1.05)	1.07 (0.99–1.16)	0.088
BMI	Continuous	Median 24 (IQR 22–25)		0.88 (0.75–1.02)	1.54 (0.99–2.39)	0.055
Level of Consciousness	Continuous	Median GCS 15 (IQR 14–15)		0.77 (0.69–0.86)	0.27 (0.12–0.61)	**0.002**
Length of Hospital Stay	Continuous	Median 5 (IQR 4–7)		1.38 (1.24–1.53)	2.67 (1.61–4.43)	**0.001**

6.Discussion

6.1 Overview of the Study

This study assessed the prevalence of pressure ulcers and their associated risk factors among hospitalized patients at critical care settings of Saint Paul's Hospital, Addis Ababa, Ethiopia. A total of 224 patients were included (95.3% respondent rate). The overall prevalence of pressure ulcers was 12.5% (28/224; 95% CI: 8.5–17.6%), suggesting that pressure injuries remain a considerable burden for healthcare systems and patients worldwide, and highlight the necessity of additional efforts in patient safety initiatives. The most affected site was the sacra l area (10.3%), followed by the buttocks (1.8%) and lumbosacral region (0.4%). Grade 1 pressure ulcers were most frequent (6.3%), followed by Grade 2 (4.0%) and Grade 3 (2.2%) from the total. This study identified that multiple independent factors are associated with the development of pressure injury

in critical care settings including smoking, level of consciousness, length of stay, frequency of repositioning and incontinence.

6.2 Interpretation of Significant Findings

Smoking: Patients who smoked were at dramatically higher risk of developing pressure ulcers (AOR = 202.96, 95% CI: 4.70–8764.32). Smoking impairs tissue perfusion, oxygenation and increases risk of endothelial injury through free radicals, increasing susceptibility to skin breakdown, impairs wound healing by decreasing fibro blast function and angiogenesis

Incontinence: Incontinent patients had significantly higher odds of developing pressure ulcers (AOR = 0.001, 95% CI: 0.000–0.22). Exposure to urine or feces increases risk of pressure ulcers in multiple ways. Incontinence keeps the skin constantly moist which leads to skin maceration, macerated skin becomes fragile and easily injured increases risk of friction and constant exposure to urine increases skin PH and feces contain digestive enzymes and bacteria contributing to ulcer formation.

Repositioning Frequency: Patients reposition-ed less frequently were at substantially higher risk than those reposition-ed every 2 hours (AOR = 110.29, 95% CI: 3.14–3874.07). prolonged exposure to pressure in one position causes capillaries to collapse decreases blood flow which also leads to accumulation of lactic acid and metabolic west product enhancing cell death. Prolonged pressure also decreases lymphatic drainage causing local edema to further decrease blood flow. This highlights the critical importance of frequent repositioning protocols to reduce pressure and shear on vulnerable areas.

Level of Consciousness: Impaired consciousness significantly increased pressure ulcer risk (AOR = 0.27, 95% CI: 0.12–0.61). Impaired level of consciousness increases the risk since patients with decreased mentation loses their protective sensory response to prolonged pressure. These patients may also have other associated factors like incontinence and poor nutrition emphasizing the need for vigilant care.

Length of Hospital Stay: Longer hospitalization was strongly associated with pressure ulcer development (AOR = 2.67 per day, 95% CI: 1.61–4.43), consistent with cumulative pressure exposure over time.

Mechanical Ventilation: Patients on mechanical ventilation had lower odds of developing pressure ulcers (AOR = 0.000, 95% CI: 0.000–0.037). This may reflect the intensive care and preventive measures routinely provided to ventilated patients.

6.3 Non-significant or Marginal Factors

Age, BMI, sex, and Braden risk levels showed trends toward increased risk but were not statistically significant after adjustment. This could be due to effective preventive measures in high-risk groups, small sample size in certain categories, or confounding by other clinical factors.

6.4 Comparison with Previous Studies

The observed prevalence aligns with studies in adult intensive care units of Arba Minch and Jinka hospitals and with the general pooled prevalence of Ethiopia(17). But is lower than most of studies off intensive care units (Rwanda, Europe and pooled worldwide (DecubICU)) and the prevalence is lower than the findings of studies in general wards of Ethiopia (Felegehiwot hospital and public hospitals of Sidama zone). The anatomic site most involved in this study was sacral area, consistent with international literature and most studies in similar settings. Grade 1 ulcers being most common is consistent with most recent studies and emphasizes the importance of early identification and preventive care, as early-stage ulcers are reversible with timely interventions.

Behavioral and clinical factors such as smoking, incontinence, repositioning frequency, level of consciousness, and length of hospital stay were significantly associated with pressure ulcer development, in consistence with findings from previous studies in both Ethiopia and other countries. Interestingly, mechanical ventilation appeared protective, likely reflecting intensive monitoring and preventive care.

6.5 Clinical Implications

The findings emphasize the importance of:

- Early risk assessment using validated tools such as the Branden scale.
- Strict adherence to frequent repositioning protocols.

- Close monitoring of high-risk patients, particularly smokers, incontinent, sedated, or unconscious patients.
- Educating healthcare professionals about prevention strategies and early identification of pressure ulcers and providing preventive devices.

7. Strength and Limitations of the study

7.1 Strengths of the Study

- Comprehensive assessment of socio-demographic, behavioral, and clinical variables.
- Use of validated risk assessment tools and robust statistical methods (bi-variable and multivariate logistic regression).
- High model fit and predictive accuracy in identifying independent risk factors.

7.2 Limitations of the Study

- Conducted in a single hospital, limiting generalizability.
- Cross-sectional design prevents causal inference.
- Small sample size in certain high-risk groups (e.g., incontinence, high Braden risk) may limit statistical power.

8. Conclusion

The prevalence of pressure ulcers among hospitalized patients at Saint Paul's Hospital critical care settings (ICU and HDU) was 12.5%, with sacra l sites being most affected and Grade 1 ulcers the most common. Smoking, incontinence, impaired level of consciousness, longer hospital stay, and less frequent repositioning were significant independent predictors of pressure ulcer development.

9. Recommendations

For Health Institutions:

- Implement and strictly enforce pressure ulcer prevention protocols, including frequent repositioning for at-risk patients.
- Provide targeted monitoring and preventive care for high risk groups
- Train healthcare staff on early identification and prevention of pressure ulcers.
- Develop a system for continuous risk assessment using tools such as the Braden scale.

For Policymakers:

- Support hospitals with resources and guidelines for pressure ulcer prevention.
- Promote awareness programs for patients and caregivers regarding pressure ulcer risk factors.

For Researchers:

- Conduct multi-center and longitudinal studies to better establish causal relationships.

10. Reference

1. Joshua S. Mervis TJP. Pressure sores are areas of skin damage resulting from a lack of blood flow due to prolonged pressure. MSD Manual 2023;1:1-4.

2. Colorado Foundation for Medical C. Classifications of Pressure Ulcers. 2008.
3. Gunningberg L. The first national pressure ulcer prevalence survey in county council and municipality settings in Sweden. Journal of Evaluation in Clinical Practice. 2013;19(5):862-7.
4. Alderden JG. Pressure injuries among critical care patients. Critical Care Nursing Clinics. 2020;32(4).
5. Belachew T. Prevalence and associated factors of pressure ulcer among adult inpatients in Wolaita Sodo University Teaching Hospital, Southern Ethiopia. 2016.
6. Gunningberg L. Pressure ulcer prevention: evaluation of an education programme for Swedish nurses. Journal of Wound Care. 2004;13(3):85-9.
7. Gedamu H, Hailu M, Amano A. Prevalence and associated factors of pressure ulcer among hospitalized patients at Felegehiwot Referral Hospital, Bahir Dar, Ethiopia. Advances in Nursing. 2014.
8. Roussou E. Quality of life of patients with pressure ulcers: a systematic review. Medicine and Pharmacy Reports. 2023;96(2):123.
9. Belachew T. Prevalence and associated factors of pressure ulcer among adult inpatients in Wolaita Sodo University Teaching Hospital, Southern Ethiopia. Prevalence. 2016;6(11).
10. Al Mutairi KB, Hendrie D. Global incidence and prevalence of pressure injuries in public hospitals: a systematic review. Wound Medicine. 2018;22:23-31.
11. Moore Z, Johansen E, Etten Mv, Strapp H, Solbakken T, Smith BE, et al. Pressure ulcer prevalence and prevention practices: a cross-sectional comparative survey in Norway and Ireland. Journal of wound care. 2015;24(8):333-9.
12. Li Z. Global prevalence and incidence of pressure injuries in hospitalized adult patients: A systematic review and meta-analysis. International Journal of Nursing Studies. 2020;105:103546.
13. Lyder CH, Ayello EA. Pressure ulcers: a patient safety issue. Patient safety and quality: An evidence-based handbook for nurses. 2008.
14. Al Kharabsheh M, Alrimawi R, Al Assaf R, Saleh M. Exploring nurses' knowledge and perceived barriers to carry out pressure ulcer prevention and treatment, documentation and risk assessment. American International Journal of Contemporary Research. 2014;4(4):112-9.
15. Mwebaza I, Katende G, Groves S, Nankumbi J. Nurses' knowledge, practices, and barriers in care of patients with pressure ulcers in a Ugandan teaching hospital. Nursing research and practice. 2014;2014(1):973602.
16. Holm B, Mesch L, Ove H. Importance of nutrition for elderly persons with pressure ulcers or a vulnerability for pressure ulcers: a systematic literature review. The Australian Journal of Advanced Nursing. 2007;25(1):77-84.
17. Shiferaw WS, Aynalem YA, Akalu TY. Prevalence of pressure ulcers among hospitalized adult patients in Ethiopia. BMC Dermatology. 2020;20.
18. Fried TR, Mor V. Frailty and hospitalization of long-term stay nursing home residents. Journal of the American Geriatrics Society. 1997;45(3):265-9.
19. Charalambous C, Vassilopoulos A, Koulouri A, Eleni S, Popi S, Antonis F, et al. The impact of stress on pressure ulcer wound healing process and on the psychophysiological environment of the individual suffering from them. medical archives. 2018;72(5):362.
20. Nhs. Pressure ulcer. 2023.
21. Adegoke B, Odole A, Akindele L, Akinpelu A. Pressure ulcer prevalence among hospitalised adults in university hospitals in South-west Nigeria. Wound Practice & Research: Journal of the Australian Wound Management Association. 2013;21(3):128-34.

22. Bereded DT, Salih MH, Abebe AE. Prevalence and risk factors of pressure ulcer in hospitalized adult patients; a single center study from Ethiopia. BMC research notes. 2018;11(1):847.
23. Biçer EK, Güçlüel Y, Türker M, Kepiçoglu NA, Sekerci YG, Say A. Pressure ulcer prevalence, incidence, risk, clinical features, and outcomes among patients in a Turkish hospital: a cross-sectional, retrospective study. Wound Manag Prev. 2019;65(2):20-8.
24. Ebrahim J, Deribe B, Biru W, Feleke T. Prevalence and factors associated with pressure ulcer among patients admitted in Hawassa University Referral Hospital, South Ethiopia. J Health Care Prev. 2018;1(105):2.
25. Ghali H, Rejeb B, Chelly S, Cheikh AB, Khefacha S, Latiri H. Incidence and risk factors of pressure ulcers in a Tunisian University Hospital. Rev Epidemiol Sante Publique. 2018;66(Supl 5):S340.
26. Gunningberg L, Stotts NA, Idvall E. Hospital-acquired pressure ulcers in two Swedish County Councils: cross-sectional data as the foundation for future quality improvement. International wound journal. 2011;8(5):465-73.
27. Jiang Q, Li X, Qu X, Liu Y, Zhang L, Su C, et al. The incidence, risk factors and characteristics of pressure ulcers in hospitalized patients in China. International journal of clinical and experimental pathology. 2014;7(5):2587.
28. Melleiro MM, Tronchin DMR, Baptista CMC, Braga AT, Paulino A, Kurcgant P. Pressure ulcers prevalence indicators and patient falls incidence in teaching hospitals in the city of São Paulo. Revista da Escola de Enfermagem da USP. 2015;49:55-9.
29. Artico M, Dante A, D'Angelo D, Lamarca L, Mastroianni C, Petitti T, et al. Prevalence, incidence and associated factors of pressure ulcers in home palliative care patients: a retrospective chart review. Palliative medicine. 2018;32(1):299-307.
30. Digesa LE, Baru A, Shanko A, Kassa M, Aschalew Z, Moga F, et al. Incidence and predictors of pressure ulcers among adult patients in intensive care Units at Arba Minch and Jinka Hospitals, Southern Ethiopia. BioMed Research International. 2023;2023(1):9361075.
31. Öztop MB, Öksüz S. Pressure Ulcers and Demographic Characteristics of Patients in a Training and Research Hospital Home Healthcare Unit. Journal of Tepecik Education & Research Hospital/İzmir Tepecik Eğitim ve Araştırma Hastanesi Dergisi. 2023;33(2).
32. Chen F. The paradox of obesity in pressure ulcers of critically ill patients. International Wound Journal. 2023;20(7):2753-63.
33. Alipoor E, Mehrdadi P, Yaseri M, Hosseinzadeh-Attar MJ. Association of overweight and obesity with the prevalence and incidence of pressure ulcers: A systematic review and meta-analysis. Clinical Nutrition. 2021;40(9):5089-98.
34. Marshall V. Hospital-acquired pressure injury prevention in people with BMI ≥30. Journal of Advanced Nursing. 2024;80(4):1262-82.
35. Neme A, Wolancho W, Nemera G, Yohanes Y. Prevalence of pressure ulcer and associated factors among hospitalized adult patients in public hospitals Sidama zone, south nations, nationalities, and peoples' regional state, Ethiopia, 2017. J Prim Care Gen Pract 2020: 3 (3): 31-45 J Prim Care Gen Pract 2020 Volume 3 Issue. 2020;3.
36. Team V, Bouguettaya A, Richards C, Turnour L, Jones A, Teede H, et al. Patient education materials on pressure injury prevention in hospitals and health services in Victoria, Australia: Availability and content analysis. International wound journal. 2020;17(2):370-9.

37. Børsting TE, Tvedt CR, Skogestad IJ, Granheim TI, Gay CL, Lerdal A. Prevalence of pressure ulcer and associated risk factors in middle-and older-aged medical inpatients in Norway. Journal of clinical nursing. 2018;27(3-4):e535-e43.
38. Borghardt AT, Prado TNd, Bicudo SDS, Castro DSd, Bringuente MEdO. Pressure ulcers in critically ill patients: incidence and associated factors. Revista brasileira de enfermagem. 2016;69:460-7.
39. Sisimwo PK, Margai M, Obaigwa E, Mbatha A, Mutua A, Atieno W. Prevalence and risk factors for Pressure ulcers among adult inpatients at a tertiary referral hospital Kenya, 2021. JOSR Journal of Nursing and health science.11(2):36-41.
40. Sancho A, Albiol R, Mach N. Relationship between nutritional status and the risk of having pressure ulcers in patients included in a home care program. Atencion Primaria. 2012;44(10):586.
41. Bekar AH, Tuncer Ö. Evaluation of Nutritional Status and Pressure Sores of Elderly Patients. European Journal of Human Health. 2024;1(1):19-26.
42. Labeau SO. Title not provided in source list. 2021.
43. Tayyib N, Coyer F, Lewis P. Saudi Arabian adult intensive care unit pressure ulcer incidence and risk factors: a prospective cohort study. International wound journal. 2016;13(5):912-9.
44. Kaşıkçı M, Aksoy M, Ay E. Investigation of the prevalence of pressure ulcers and patient-related risk factors in hospitals in the province of Erzurum: a cross-sectional study. Journal of tissue viability. 2018;27(3):135-40.
45. Kennerly S, Sharkey P, Horn S, Alderden J, Yap T. Nursing assessment of pressure injury risk with the Braden scale validated against sensor-based measurement of movement. Healthcare 10 (11), 2330. 2022.

Annex I: Information sheet

Good morning/afternoon! My name is Yohannes dendir. I am a postgraduate student at Saint PAUL'S hospital millennium medical college, Department of anesthesiology, critical care and pain medicine conducting the following research.

Title of the research: prevalence and associated risk factors for the development of pressure ulcer at critical care settings of st. Paul`s Hospital.

Purpose: This Self-administered questionnaire is provided to assess your socio demographic and clinical data about to assess possible risk factors of pressure ulcer and prevalence. Your name will not be written in this form and all the information you will give is kept confidential. If you do not want to answer all or some of the questions, you do have the right to do so. However, your willingness to answer all of the questions is highly appreciated. It doesn't take more than 10 minutes. All admitted adult patient expected to answer. Benefit and risk: Your participation in this study help us in assessing the the possible risk factors and to put base for further prevention strategies for pressure ulcer. Participating in the study does not involve any risks other than 10 or less minutes to conduct the interview.

Annex II Consent form

Code number ----------

The purpose of this study is to assess the prevalence and associated risk factors for the development of pressure ulcer at st. Paul Hospital admitted patients.

I understand that participating in this study is completely voluntarily and do not have any payment or incentive; provided my privacy is guaranteed and does not expose to another third party.

I promise to answer honestly to all questions and not provide any false information or in any other way purposely mislead the researcher.

Signature of participant _____ Date _____

Name and Signature of the data collector who sought the consent_____

Name and signature of the supervisor _____

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Annex III Questionnaires

Part I: Socio Demographic Characteristics of respondents

Instruction: Please circle the number in front of the option you choose[2]

No	Questions	Response
1	Sex	A, male B, female
2	Age	……..
3	Residency	A, urban B, rural
4	Educational status	A, unable to read and write B, primary education C, secondary to diploma education D, degree and above
5	BMI	----------

Part II Clinical data

No	Question	Response
1	How many days do you stay in this Hospital?	-------
2	Do you have any previously known comorbid	A, yes

[2]

	illness?	B, no
3	If the 2nd question is yes what type of disease do you have?	A, diabetics B, stroke C, cardiovascular D, renal E , other
4	Who is responsible to change for position at bed?	A, self B, with assistance with family member C, completely with others
5	How frequent do you change your position?	A, every 2 hours B, every 4 hours C, 4 times in a day D, less than 4 times per day
6	Activity	Bed bound Chair bound Walk occasionally Walk frequently
7	Diagnosis and reason for admission	
8	Incontinence	Yes No
9	Have the patient been sedated	Yes No
10	Level of consciousness	----------
11	Had the patient been on mechanical ventilator	Yes no
12	How many days does the patient stayed in the hospital	----------
13	How was the patient admitted?	From emergency room From operating room after elective

		surgery
14	Does the patient has pressure ulcer?	Yes No
15	If yes, site of the ulcer	----------

Part III Braden risk assesment scale

No	Questions to be asses ed	Assessments observed or answered
1	Sensory perception	A, Completely limited B,very limited C, slightly limited D no impairment
2	Moisture	A, constantly moist B, very moist C, occasionally moist D, rarely moist
3	Activities	A, bed fast B, chaire fast C, walks occasionally D, walks frequently
4	Mobility	A, completely imobile B, very limited C, slightly limited D, no limitation
5	Nutrition	A, very poor B, probably in adequate C, adequete D, excellent

6	Friction or shear	A, problem B, potential problem C, no apparent problem

Behavioral factors

No	Questions	Response
1	Do you smoke cigarette?	Yes No
2	If yes, how many days in a week do you? (from 0-7 days)	
3	Do you drink alcohol?	Yes No
4	If yes, how many days in a week do you	
5	Do you chew chat?	Yes No
6	If yes, how many days in a week do you?	

Annex III: Declaration form

This is to certify that the thesis is prepared by **Dr. Yohannes Dendir** entitled "**Prevalence and Associated Factors with the Development of Pressure Ulcer in Adult Intensive Care and High Dependency Unit at Saint Paul's Hospital Millennium Medical College"** submitted in partial fulfillment of the requirements of speciality complies with the regulations of the university and meets the accepted standards with respect to originality and quality. This thesis has not been presented for a degree in any other university, and all sources of materials used for the thesis have been duly acknowledged.

ASSURANCE OF PRINCIPAL INVESTIGATORS

I, the undersigned, declare that this postgraduate degree thesis is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

1.Name of the student: _____Signature_____ Date. _____

APPROVAL OF THE ADVISORS

This thesis has been submitted with my approval as university advisor.

APPROVAL OF ADVISOR

Name of the first advisor: _____Signature _____ Date. _____

Name of the second advisor: _____Signature _____ Date. _____

APPROVAL OF EXAMINER

Name: _____

Signature _____ Date. _____

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