

## Investigating the Frequency of Pressure Ulcers and Their Effective Factors in Intensive Care Units

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### ABSTRACT

**Background:** For patients with prolonged bed rest and immobilization because of motor or consciousness disorders, many factors may contribute to the development of pressure ulcers. To this end, the present study aimed to investigate the frequency of pressure ulcers and the factors affecting the development of this condition in intensive care units (ICUs).

**Methods:** In this descriptive cross-sectional study, the case files and records of patients hospitalized between March 2017 and March 2018 entered the study using the census method. The necessary information including age, gender, location of pressure ulcers, number of ulcers on each part of the body, length of stay in ICU, and underlying diseases was extracted from the files and recorded in the data checklist. In the end, the extracted data were analyzed with SPSS 25.

**Results:** Of the 781 patients studied, 71 (9.1%) had pressure ulcers, of whom 34 were men and 37 were women. A statistically significant difference was found between men and women in terms of the incidence of pressure ulcer ( $p = 0.0013$ ). The most common sites of pressure ulcers were buttock with 34 cases (47.9%) and sacrum with 21 cases (29.6%).

**Conclusion:** Old age and prolonged stay in ICU are important determinants of the development of pressure ulcers.

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Bedsore is one of the most important complications that may prolong the patients' stay in intensive care units (ICUs) and increase their morbidity, mortality and health care costs [1]. Bedsore or pressure ulcers (PUs) refer to a skin integrity disorder caused by prolonged pressure due to immobilization in the bed [2]. This prolonged pressure leads to the impaired blood supply and reduced delivery of micronutrients and oxygen to the pressured area, which ultimately results in cell death and appearance of sores [3]. The normal capillary pressure is between 10 and 30 mmHg and the exertion of higher pressures to the tissue may result in hypo-perfusion [4-5] and increases the risk of bedsore

[6]. The ability of skin tissue to withstand pressure depends on factors such as fragility, friction, and moisture. The underlying tissues and blood vessels can also accelerate or delay the appearance of bedsore [7]. The incidence of pressure ulcers varies with the department. According to previous studies, this rate ranges from 0.4 to 38 percent in acute intensive care units, 2.2 to 39.4 percent in long-term intensive care units, and 0 to 17 percent in home care. The global incidence of pressure ulcers in intensive care units ranges from 1 to 56 percent [6, 8-9]. In one study, the incidence of pressure ulcers in all hospitals affiliated to Shiraz University of Medical Sciences was reported to be

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19.1%, with the highest incidence rates being related to orthopedic (28.6%) and surgery (12.9%) wards [10]. Contrary to the misconception that pressure ulcers are solely caused by inadequate nursing care, numerous other causes and illnesses can also make a patient susceptible to the development of these ulcers [11]. In a study by González-Méndez et al., it was reported that pressure ulcers occur at much higher rates than what is reported in recent studies, and that the severity of the disease and the prognostic score are two of the most important risk factors for the development of this condition and contrary to popular belief, the length of stay in the intensive care unit acts more as a protective factor [12]. In a study on the prevalence and causes of pressure ulcers, the area with the highest risk was found to be the sacrum (81.7%) and it was reported that the major determinants of the occurrence of pressure ulcers include skin moisture, urinary excretion circumstances, level of consciousness, frequency of position changes, poor nutrition, and low albumin levels, heart failure, low hemoglobin level, abnormal hematocrit, and hypertension [10]. Other studies have also recognized age as a determinant of the occurrence of pressure ulcers [13-14]. Considering the high prevalence of pressure ulcers, the wide variety of factors that can contribute to this condition, the association of this condition with the location and quality of care, and the importance of identifying its risk factors, this study attempted to determine the incidence of pressure ulcers and the factors associated with this condition in intensive care units (ICUs) of Zahedan.

## Methods

This descriptive cross-sectional study was conducted with the authorization of the Ethics Committee (Code: IR.ZAUMS.REC.1397.178) and the Research and Technology Deputy of Zahedan University of Medical Sciences. Using the sample size formula and the reports of previous studies, the sample size was calculated to 781 (8). Given the number of ICU beds and the rate of hospitalization, it was predicted that the target sample size can be reached by using the census method. Therefore, the medical records of all patients who were hospitalized between March 2017 and March 2018 were extracted from the archive and the cases that met the inclusion criteria were included in the study.

Inclusion criteria: Age of over 18 years; more than 24 hours of stay in ICU

The necessary information including age, gender, location of pressure ulcers, number of ulcers on each part of the body, length of stay in the hospital, and underlying diseases were extracted from the medical files and recorded in the data checklist. Finally, data were analyzed in SPSS 25 using descriptive statistics (mean, standard deviation, and frequency), chi-square test, and T-test. The level of statistical significance was considered to be 0.05.

## Results

Of the 781 patients studied, 481 (61.6%) were male and 300 (38.4%) were female. Using the Chi-square test, this gender difference was found to be statistically significant. Of all the patients, 71 (9.1%) had developed pressure ulcers, of whom 34 were men and 37 were women. A statistically significant difference was found between men and women in terms of the incidence of pressure ulcer (Table 1).

Patients with pressure ulcers had a mean age of  $62.94 \pm 20.57$  and those without pressure ulcers had a mean age of  $50.21 \pm 22.52$ , which were found to be significantly different ( $P = 0.022$ ).

Of the 71 patients with pressure ulcers, 34 (47.9%) had ulcers in the buttock area, 21 (29.6%) in the sacrum area, 6 (8.5%) in the buttock and sacrum areas, 3 (4.2%) in the buttock and shoulder areas, 2 (2.8%) in the iliac area, 2 (2.8%) in the occiput area, 1 (1.4%) in the buttock and spine areas, 1 (1.4%) in the heel area, and 1 (1.4%) in the sacrum and occiput areas. In terms of ulcer frequency in each position, 48 patients had one ulcer, 13 patients had two ulcers, 7 patients had three ulcers, and 3 patients had four ulcers (Chart 1).

Patients with pressure ulcers had an average length of stay (LOS) of  $23.49 \pm 18.23$  days and those without pressure ulcers had an average LOS of  $14.95 \pm 11.50$ . Statistical tests showed a statistically significant difference between the groups in this respect ( $P = 0.000$ ).

In terms of the cause of hospitalization, 387 patients had been hospitalized because of trauma, 164 for decreased consciousness, 55 for intracranial hemorrhage, 38 for stroke, 32 for drug poisoning, 25 for cancer, 23 for cardiopulmonary arrest, 16 for sepsis, and 41 for other causes (Chart 2).

Although the majority of patients were hospitalized for trauma, a smaller portion of trauma patients had developed pressure ulcers. The opposite trend was observed in patients hospitalized for decreased consciousness, cardiopulmonary arrest, or sepsis, in the sense that a larger portion of these patients had developed pressure ulcers. Among these, only the trends of the patients hospitalized for trauma and decreased consciousness were statistically significant ( $p = 0.000$ ).

Of the 71 patients with pressure ulcers, 19 had stage I, 45 had stage II, and 7 had stage III ulcers (Chart 3).

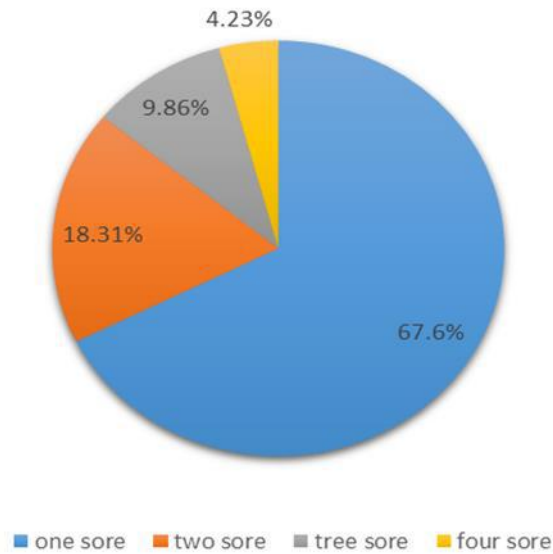
Among pressure ulcers of different stages, stage II was the most frequent.

In terms of underlying diseases, 338 of the patients had diabetes, 252 had hypertension, 125 had renal impairment, 77 had respiratory diseases, and 22 had cardiovascular diseases, none of which were statistically significant (Chart 4).

**Table 1- Comparison of the gender of patients with and without pressure ulcers**

Gender	Gender		P-value
	Male Frequency (percentage)	Female Frequency (percentage)	
With pressure ulcers	34 (7.1)	37 (12.3)	0.013
Without pressure ulcers	447 (92.9)	263 (87.7)	0.000
Total	481 (100)	300 (100)	0.013

**Chart 1- Frequency of wounds per position**



**Chart 2- Comparison of the incidence of pressure ulcers in terms of the cause of hospitalization**

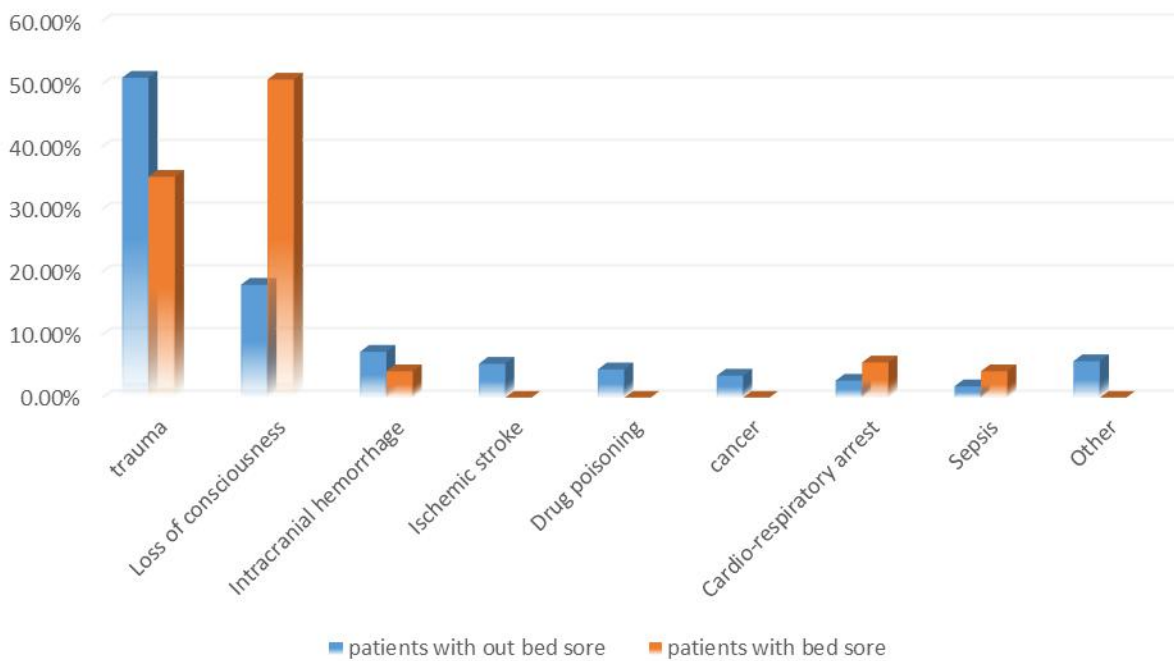


Chart 3- Frequency of stage I, II, and III pressure ulcers in patients

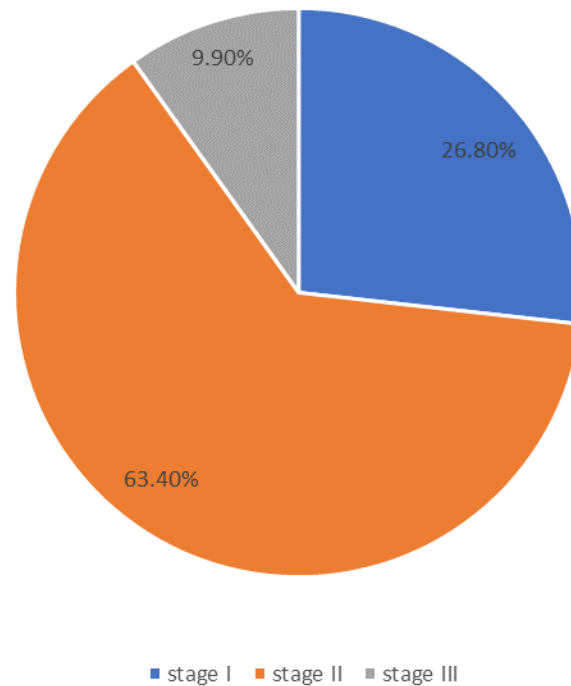
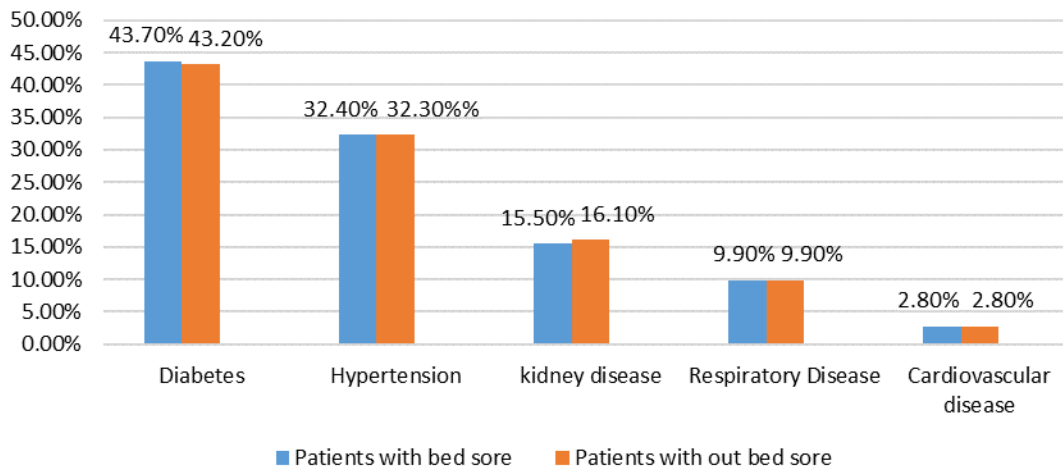


Chart 4- Comparison of patients based on underlying diseases



## Discussion

This study found a direct relationship between LOS and the incidence of pressure ulcers, which contradicts the previous findings that suggest that long-term hospitalization acts as a protective factor (12). However, it should be noted that the quality of nursing care and the type of equipment used in long-term care can lead to significantly different findings regarding this relation. The present study also showed that old age is a determining factor for the occurrence of pressure ulcers. The majority of patients who had developed pressure

ulcers were hospitalized for trauma and decreased consciousness with unknown causes, but since most of the other patients were also hospitalized for the same reasons, we cannot regard the cause of hospitalization as a determinant of the development of pressure ulcers. However, the prevalence of pressure ulcers was higher in patients with trauma, decreased consciousness, sepsis, and cardiac arrest than among other patients. Other factors, including underlying diseases, were not correlated with the incidence of pressure ulcers. The most common sites for pressure ulcers were sacrum and buttock and the most common stage of pressure ulcer was

stage II. In line with the findings of this study, Kaitani et al. reported that most of the pressure ulcers they observed in the trunk were of stage II or higher, because patients had a high BMI and it was difficult to change their position, give them bed bath, conduct skin examination, and provide other nursing services. Therefore, these pressure ulcers were appearing in areas that are hard to see and examine, and in contrast, ulcers on the legs were often of stage I (8). Different studies have reported different results about the incidence rate of pressure ulcers. The study of González-Méndez et al. reported this rate to be 8.1% (12), which is close to the 9.1% rate observed in this study. But in the study of Tescher et al., this rate was 3.1%, although they excluded stage I ulcers with reversible causes (15). In a study on the hospitals in Belgium, this rate was 12.1% and the highest prevalence of pressure ulcers was observed in ICUs and elderly patients, which are consistent with our findings. However, this study reported that the most common sites of ulcer were buttock and heel areas, which is not completely consistent with our results, as the most common ulcer sites in this study were buttock and sacrum (16). Other notable issues related to this discussion are the limited use of preventive methods and the scales for measuring the risk of pressure ulcers. According to Vanderwee et al., hospitals make scant use of preventive interventions for pressure ulcers, which indicates a relatively low quality of care. Therefore, it is important to pay special attention to the implementation of pressure ulcer prevention guidelines and regular re-evaluation of these guidelines (16). Elderly and ICU patients are highly exposed to the risk of developing pressure ulcers. These patients have several risk factors such as limited mobility and activity, older age, perfusion and oxygen delivery problems, and general health issues, which explain this high risk (17-19). A pressure of 500 mmHg for 2 hours or 150 mmHg for 10 hours can produce a pressure ulcer. However, only 60 mmHg of pressure for 1 hour is enough to cause microscopic changes in tissues (20). In line with the results of this study, previous studies have shown that the following factors increase the likelihood of pressure ulcer: inactivity, admission to ICU, malnutrition, urinary and fecal incontinence, hypoalbuminemia, spinal cord injury, stroke, hypertension, decreased consciousness (mental state), fractures or major orthopedic surgeries, old age, trauma, reduced tissue perfusion, impaired wound healing, inadequate nursing care, and chronic illnesses that make the patient dependent on the bed (14, 21, 22). Other etiologic factors of pressure ulcer development are shearing and friction. Friction occurs when the patient moves up or down in the bed, which may lead to abrasion and rupture of the skin. Shearing is the force generated when two parts of the body move against each other, for example, when the tissue beneath a skin moves but the skin itself is stationary (e.g. when the patient slides down a bed whose head is raised and or when

the patient slides down a chair) (22, 23). Stretching or bending of blood vessels may also cause ischemia (24). A cohort study conducted in neurology ICUs in Texas found that all patients were at risk of developing pressure ulcers. In this study, the prevalence of pressure ulcers in patients with incontinence (urine or bowel) was 26% and in other patients was 10%, and this difference was found to be statistically significant. Patients with low body weight and albumin level of less than 35g/lit were also at higher risk of pressure ulcer (25). Since one of the limitations of the present study is the lack of data on albumin level and body weight, no conclusion can be made in this regard. But about urinary and fecal incontinence, it can be argued that since most of the patients admitted to ICUs have Foley catheter, urinary incontinence cannot be considered a major risk factor for low humidity and pressure ulcers. However, fecal incontinence, especially if it is in the form of diarrhea, can contribute to the development of pressure ulcers by creating poor skin moisture conditions and causing harmful PH effects.

## Conclusion

According to the findings of this study, old age and prolonged length of stay are important determinants of the development of pressure ulcers.

## Limitations

This study did not examine the hemodynamic condition, albumin level, and the type and amount of vasoconstrictor medications that patients may have used to regulate blood pressure, all of which may be effective in the development of pressure ulcers. Further, since data were collected from the patient records, it was not possible to observe the quality of nursing care received by the patients, which may have indeed affected the development of ulcers. It is recommended to conduct a descriptive observational study on the same units to examine all factors that may contribute to the development of pressure ulcers.

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