

## Predicting pressure ulcer risk: a study of the predictive validity of the Braden scale at different health care settings

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**Abstract:** Pressure ulcers are serious problems that occur frequently in acute and long term facilities. Once they occur, pressure ulcers may lead to sepsis and death. A key to prevention is early detection of at-risk patients with a valid and reliable pressure ulcer risk assessment instrument. The Braden scale is one of the most intensively used tools designed to facilitate that assessment. The Braden scale consists of six subscales that evaluate a patient's sensory perception, activity level, mobility, and nutrition status and the skin's exposure to moisture, friction and shear forces. Therefore, the aim of the study is to identify the predictive validity of the Braden scale at different health care settings. A total of 100 male and female patients, older than 19 years, from a variety of health care settings orthopedic, neurologic-emergency, and intensive care units, who don't have pressure ulcers, admitted within the previous 72 hours, have anticipated hospital stay period at least 1 week were assessed. A descriptive correlational research design was utilized. Questionnaires filled by the researcher were: Socio-demographical and biomedical data sheet and Braden scale for predicting pressure ulcer risk. Observations were made every 48 to 72 hours for a minimum of 1 to a maximum of 4 weeks. The outcome (presence/absence and stage of pressure ulcer) was documented at each assessment. 29% of subjects developed pressure ulcers. The incidence was 15% for stage I, and 14% for stage II, the Braden scale showed a 66.7% sensitivity, 100% specificity, 66.7% predictive value of positive test and predictive value of negative test was 96.3%, and the cut-off point for classifying the pressure ulcer risk was 18, with overall accuracy 92.5%. The study recommended using the Braden scale but, for generalization, we need to test the tool's specificity and sensitivity at multi-center and for at least 1000 patients from different population to test the predictive validity of the Braden scale.

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**Key words:** pressure ulcer, Braden scale, predictive validity, specificity, sensitivity.

### 1. Introduction:

Because the skin is the body's first line of defense, an intact skin surface takes on added significance. Altered skin integrity is potentially dangerous and can be life threatening. Maintenance of skin integrity and promotion of wound healing are important aspects of nursing care in all health care settings (Jiricka, 2009). Pressure ulcers, which altered skin integrity, are serious problems and still among the most costly, yet preventable, injuries with a high prevalence and incidence in acute and long term care (Breslow, 2012).

Bedsore, more accurately called pressure sores or pressure ulcers, are areas of damaged skin and tissue that develop when sustained pressure - usually from a bed or wheelchair - cuts off circulation to vulnerable parts of the body, especially the skin on the buttocks, hips and heels. Without adequate blood flow, the affected tissue dies. (Mayo clinic staff, 2012). Pressure ulcers can occur in persons who are wheelchair-bound or bed-bound, sometimes even after a short time (2 to 6 hours) (Xakellis & Mccance 2013).

Pressure ulcers are a challenge for all healthcare facilities. This painful skin wounds pose the risk of deadly infection. Immobile patients have a 100% chance of developing pressure ulcers, and individuals with pressure ulcers have up to six times as great a risk of death than patients who do not develop pressure ulcers. Although pressure ulcers are not always preventable, healthcare facilities can take steps to reduce their severity and incidence (the USA. National Pressure Ulcer Advisory Panel, 2013). Also Marks (2009) claimed that, Identifying individuals at risk for pressure ulcers and initiating preventive measures is an important means of reducing pressure ulcer prevalence and incidence.

The clinical practice guideline on pressure ulcer prevention from the Agency for Health Care Policy and Research [AHCPR], provides a starting point for identifying at-risk individuals who need preventive interventions and the specific factors that place these individuals at risk. Such patient include those bedfast and chairfast individuals or those with impaired ability to change position are at risk for pressure ulcers because of immobility. The guideline suggests that

these individuals be assessed for additional factors that increase risk for developing pressure ulcers, including incontinence, nutritional factors such as inadequate dietary intake or impaired nutritional status, and altered level of consciousness (Gawron, 2008).

Several pressure ulcer risk assessment tools are available to help practitioners identify individuals who might develop a pressure ulcer. These include the Norton Scale, the Gosnell Scale, the Braden Scale, the Knoll Scale, and the Waterlow Scale. All risk assessments should be documented, this may be accomplished by using a validated risk assessment tool (AHCPR, 2012).

Moreover Halfens and Achterberg (2007) added that, there are two risk assessment scales—the Norton and the Braden Scales—are mentioned in the AHCPR guideline as being appropriate clinical tools for determining pressure ulcers risk because of the amount of clinical research supporting their reliability and validity. The Braden Scale, is the most commonly used pressure ulcer assessment scale in the United States.

Bliss and Clarke, (2012) added that in the last few years more and more institutions have become interested in the Braden scale (which used in identifying the risk of developing pressure ulcers). One reason for this is that the Braden scale is the most extensively investigated risk assessment scale. Moreover, the Braden scale has been recommended by the Agency for Health Care Policy and Research. Several studies show that, in general, the sensitivity and specificity of the scale are sufficient. However, other studies show that the sensitivity and specificity are not high, and that they could be enhanced.

If the conditions leading to the pressure ulcer are not rapidly corrected, the localized skin damage will spread to deeper tissue layers affecting muscle, tendon, and bone (Reddy, Gill & Rochon 2013). A pressure ulcer can progress from a small irritated but unbroken skin patch to a potentially life-threatening wound involving extensive tissue death and infection. Treatment of the serious pressure ulcer may include drying out the wound, debriding (excising) the dead tissue, and administering systemic antibiotics (Sussman & Bates-Jensen, 2012).

#### **Operational definition:**

Predictive validity of pressure ulcer scale defined as a scale can correctly predict the risk of developing pressure ulcer that we theoretically think it should be able to predict. Predictive validity is generally expressed in terms of sensitivity and specificity.

#### **Aim of the Study**

The aim of the current study was to identify the predictive validity of the Braden scale at different health care settings at El-Manial university hospital.

## **2. Subjects and Methods:**

#### **Research Design:**

A descriptive correlational design was utilized to achieve the purpose of the study. The research described what exists, and categorized information obtained from the application of the Braden scale.

#### **Research question**

This study helped in answering the following question: What is the predictive validity of the Braden scale as applied to a variety of health care settings at El-Manial university hospital?

#### **Sample and Setting:**

A purposive sample consisting of 100 adults male and female patients will be recruited in the study according to the following criteria, the patients don't have pressure ulcers on admission, admitted within the previous 72 hours, have anticipated hospital stay period at least 1 week, from a variety of health care settings, and have affection of any of the following items (sensory perception, moisture, activity, mobility, nutrition and friction and shear), this is in accordance of the Braden scale categories. The study was conducted in different care settings (orthopedic unit, neurologic-emergency unit, and different I.C.U.s.) at El-Manial university hospital.

#### **Protection of human rights**

An official permission to conduct the proposed study was obtained from the concerned hospital authorities at El-kasr El-aini hospital, and head nurses of each unit. In addition, a written consent was obtained from each participating conscious patient to be included in the study, and also, clarification of the nature and purpose of the study was done on the initial interview with each conscious patient.

#### **Tools of Data collection:**

After reviewing related literature to fulfill the aim of the study, two different tools were utilized to collect data pertinent to the current study, Socio-demographic and biomedical data sheet and Braden scale.

##### **a) Socio-demographic and biomedical data sheet:**

Socio-demographic and biomedical data sheet was developed by the researcher to assess two main aspects, The first, which is related to biographical and social data, it include; name, age, gender, marital status, level of education, and occupation. The second, is a biomedical data related to pressure ulcer it include; the unit/section, date of admission, presence of significant comorbidities, soiling, special habits, past history of pressure ulcer, preventive methods used, presence of special restrictive devices, pressure ulcer outcome (presence or absence of pressure ulcer), pressure ulcer time, and the site of pressure ulcer.

##### **b) Braden scale:**

Pressure ulcer-prevention measures (including prescribed turning schedules and the use of pressure-reducing support surfaces) are used on the basis of a patient's assessed level of risk; the Braden scale is a

tool designed to facilitate that assessment. Developed in 1987 by Barbra J. Braden, and Nancy Bergstrom, PhD, RN,FAAN, the Braden scale consists of six subscales that evaluate a patient's sensory perception, activity level, mobility, and nutrition status and the skin's exposure to moisture, friction, and shear forces. On five subscales (sensory perception, mobility, activity, moisture, and nutrition), patients can receive scores from 1 to 4, with 4 representing the highest. On the remaining subscale (friction and shear) patients are ranked from 1 to 3. adding the six subscale scores yields a total Braden scale score, which can range from 6 to 23. lower total scores are associated with a higher risk of developing pressure ulcers (Bergstrom& Braden, 2009).

#### Procedure:

Once permission was granted to proceed with the proposed study, a pilot study was done. After that the investigator initiated data collection. At initial interview, conscious patients who agreed to participate in the study and met the inclusion criteria were informed about the nature and the purpose of the study. Data were collected by the researcher utilizing the study tools through interviews, history taken (from patient or relatives), observation and physical examination ( skin assessment, and pressure ulcer assessment). The current skin condition was assessed On admission. If an ulcer was discovered at this time, the patient and/or the nurse were informed, and the patient was excluded from the study. If no ulcer was found, the patient was included in the study. Patients were assessed on the first day of the study and every 72 hours from at least 1 week until discharge or for a maximum of 4 weeks. The frequent reassessment was performed so that the issue of timing for optimal prediction could be examined. Skin condition and the level of risk (Braden scale score), assessed and recorded, at each observation by the investigator. If an ulcer was detected, it was staged (I to IV) and recorded. If the ulcer appeared to be stage I, it was closely examined and reevaluated 2 to 4 hours later to distinguish it from transient reactive hyperemia.

#### Pilot study

A pilot study was conducted on 25 patients who met the inclusion criteria, to test feasibility of the study, as well as clarity and objectivity of the tools. The patients were assessed twice only and it had an error in the analysis of data, so in the current study we assessed the patients from 1 to 4 weeks, 2 times per/week. So, the pilot sample was excluded from the main study.

#### Statistical Analysis

Data analysis was performed using Statistical Package for the Social Science (SPSS version.16) was used for statistical analysis of the data, as it contains the test of significance given in standard statistical books. Statistical significance was considered at  $P$ -value < 0.05

#### 3. Results:

To fulfill the objectives of this study, finding will be presented in four main sections in the following sequence.

##### Section I:-

This section represents results pertaining to sample characteristics and demographic data as; age, gender, marital status, level of education and occupation. (Table 1& figures 1-4)

Table (1) shows that nearly more than half of the study sample were males (56%), whereas the rest of the study sample were females (44%). The majority of the study sample was in the age group of thirty, twenty, and fifty (30%, 22%, & 20% respectively).

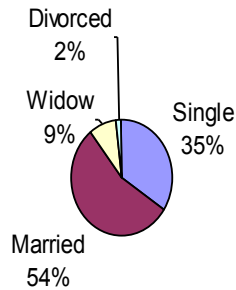
Figures (1&2) illustrate that the majority of a study sample were married, for male and female (67%, 54% respectively), followed by single male and female (19%, 35% respectively).

Figure (3) reveals that the majority of patients were either read and write or illiterate. In male patients the highest percentage (37.7%), for those who can only read and write, while approximately half of the female patients (48.8%), were illiterate.

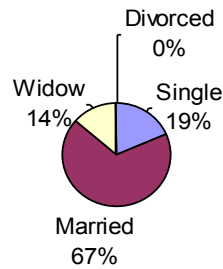
Figure (4) shows that the majority of the female subjects (86%), were housewives, while (62.3%) of the male subjects were skilled workers and followed by the incidence of unemployed and students' male patients (20.8% and 15.1% respectively).

**Table 1: Frequency distribution of patient's age group and gender (n=100)**

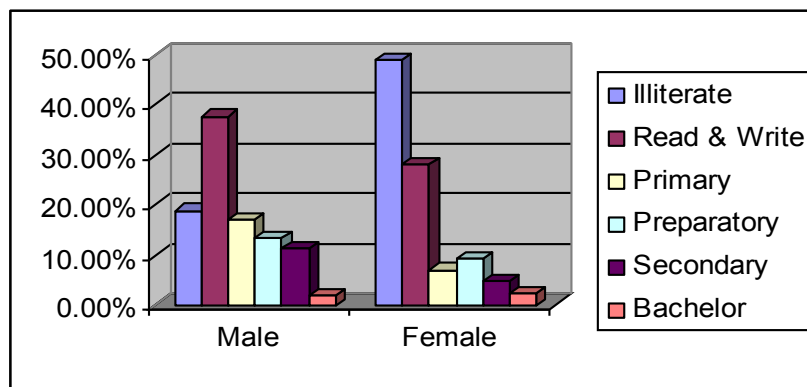
| Parameter          | Gender           |                | Total |
|--------------------|------------------|----------------|-------|
|                    | Female<br>(n=56) | Male<br>(n=44) |       |
|                    | %                | %              | %     |
| Age groups (Years) |                  |                |       |
| 19-30              | 28.6             | 13.6           | 22    |
| 31-40              | 28.6             | 31.8           | 30    |
| 41-50              | 19.6             | 13.6           | 17    |
| 51-60              | 14.3             | 27.3           | 20    |
| 61-70              | 5.4              | 9.1            | 7     |
| Over 71            | 3.6              | 4.5            | 4     |
| Total              | 100              | 100            | 100   |



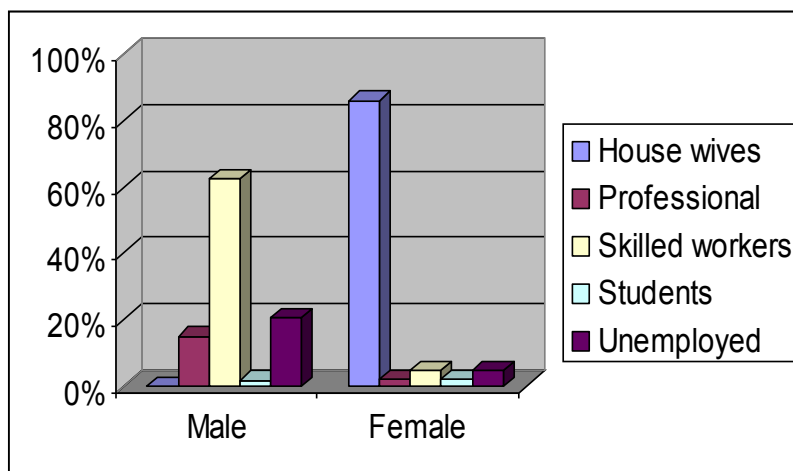
**Figure 1:** Frequency distribution of male marital status (n= 56).



**Figure 2:** Frequency distribution of female marital status (n= 44).



**Figure 3:** Frequency distribution of patient's level of education (n=100).



**Figure 4:** Frequency distribution of patient's occupation (n=100).

**Section II:-**

This section deals with biomedical data and data related to pressure ulcer risk factors as presence of significant comorbidities, soiling, age, gender and presence of special restricted devices in relation to pressure ulcer outcome (presence or absence of pressure ulcer). (Tables 2-5)

Table (2) shows that the highest incidence for stage I pressure ulcer was between diabetic patients and the patients who have complex comorbidities (26.7%, 26.7%). And for stage II, the highest incidence was for the patients having complex comorbidities and the diabetic patients (28.6%, 21.4% respectively), while patients complaining of hypertension alone having less incidence for

developing stage I and stage II pressure ulcer (13.3%, 7.1% respectively). There was statistical significance between pressure ulcer outcome and presence of significant comorbidities.

Table (3) shows that the incidence of male was the double incidence of female patients at stage I pressure ulcer (66.7%, 33.3% respectively). While, at stage II pressure ulcer, the incidence of male was equal to the female incidence (50%, 50%). There was no statistical significance between pressure ulcer outcome and gender ( $p=0.623$ ).

Table (4) shows that the highest incidence for stage I pressure ulcer was between the patients whose age ranged from 19 to 30 years (26.6%). And the

highest incidence for stage II pressure ulcer was between those whose age ranged from 31 to 40 years (28.6). While all the patients whose age was over 70 years were developed pressure ulcers, stage I and stage II. There was statistical significance between pressure ulcer outcome and age ( $p=0.01$ ).

Table (5) shows that at stage I pressure ulcer, the highest incidence for the patients having soiling from both urine and faeces (66.7%), and (26.7%) for the patients having only soiling from urine. While at stage II pressure ulcer, more than two third of the sample (78.6%) having soiling from both urine and faeces. There was statistical significance between pressure ulcer outcome and incontinence ( $p=0.00$ ).

**Table 2:** Frequency distribution of pressure ulcer outcome in relation to significant comorbidities (n=100).

| Variable              | Pressure ulcer outcome |                        |                         | Total<br>(n=100) |
|-----------------------|------------------------|------------------------|-------------------------|------------------|
|                       | No P.U.<br>(n=71)      | Stage I P.U.<br>(n=15) | Stage II P.U.<br>(n=14) |                  |
|                       | %                      | %                      | %                       | %                |
| Diabetes              | 14.1                   | 26.7                   | 21.4                    | 17               |
| Hypertension          | 16.9                   | 13.3                   | 7.1                     | 15               |
| Hypotension           | 2.8                    | 6.7                    | 7.1                     | 4                |
| Complex-comorbidities | 4.2                    | 26.7                   | 28.6                    | 11               |
| No comorbidities      | 62                     | 26.7                   | 35.7                    | 53               |
| Total                 | 100                    | 100                    | 100                     | 100              |

\* (Complex comorbidities); presence of diabetes and hypertension together.

**Table 3:** Frequency distribution of pressure ulcer outcome in relation to gender (n=100).

| Variable | Pressure ulcer outcome |                        |                         | Total<br>(n=100) |
|----------|------------------------|------------------------|-------------------------|------------------|
|          | No P.U.<br>(n=71)      | Stage I P.U.<br>(n=15) | Stage II P.U.<br>(n=14) |                  |
|          | %                      | %                      | %                       | %                |
| Male     | 54.9                   | 66.7                   | 50                      | 56               |
| Female   | 45.1                   | 33.3                   | 50                      | 44               |
| Total    | 100                    | 100                    | 100                     | 100              |

**Table 4:** Frequency distribution of pressure ulcer outcome in relation to age (n=100).

| Variable    | Pressure ulcer outcome |                        |                         | Total<br>(n=100) |
|-------------|------------------------|------------------------|-------------------------|------------------|
|             | No P.U.<br>(n=71)      | Stage I P.U.<br>(n=15) | Stage II P.U.<br>(n=14) |                  |
|             | %                      | %                      | %                       | %                |
| 19-30 yrs.  | 22.5                   | 26.6                   | 14.2                    | 22               |
| 31-40 yrs.  | 32.3                   | 20                     | 28.6                    | 30               |
| 41-50 yrs.  | 19.7                   | 20                     | 0                       | 17               |
| 51-60 yrs.  | 22.5                   | 6.6                    | 21.4                    | 20               |
| 61-70 yrs.  | 2.8                    | 13.3                   | 21.4                    | 7                |
| Over 70 yrs | 0                      | 13.3                   | 14.3                    | 4                |
| Total       | 100                    | 100                    | 100                     | 100              |

**Table 5:** Frequency distribution of pressure ulcer outcome in relation to presence of soiling (n=100).

| Variable        | Pressure ulcer outcome |                        |                         | Total<br>(n=100) |
|-----------------|------------------------|------------------------|-------------------------|------------------|
|                 | No P.U.<br>(n=71)      | Stage I P.U.<br>(n=15) | Stage II P.U.<br>(n=14) |                  |
|                 | %                      | %                      | %                       | %                |
| Urine           | 9.9                    | 26.7                   | 14.3                    | 13               |
| Faeces          | 0                      | 0                      | 7.1                     | 1                |
| Complex-soiling | 22.5                   | 66.7                   | 78.6                    | 37               |
| No soiling      | 67.6                   | 6.7                    | 0                       | 49               |
| Total           | 100                    | 100                    | 100                     | 100              |

\* (Complex-soiling), presence of soiling from both urine and faeces.

**Section III:-**

This section is concerned with identification of the sensitivity, specificity, predictive value of positive (PVP) and negative (PVN) tests, the cut off point for classifying the pressure ulcer risk and percent correct for scores of the Braden scale. Sensitivity, the tool's accuracy in differentiating true positive from false negatives, and specificity, the tool's accuracy in differentiating true negatives from false positives, together with the predictive value of positive and negative tests, are held to be measures of the predictive validity of the tool (Braden & Maklebust, 2005). (Tables 6-7).

This section aims at answering the following main research question. What is the predictive validity of the Braden scale as applied to a variety of settings?

Using discriminant analysis model with stepwise approach, the following parameters ( age, presence of significant comorbidities, gender, soiling, presence of past history of pressure ulcer, preventive methods used, site of pressure ulcer, beginning time of pressure ulcer, inpatient departments, presence of special restricted devices, first reading second reading third reading, and fourth reading) well the independent predictors with end point chosen event (no pressure ulcer, stage I pressure ulcer, and stage II pressure ulcer) as dependent predictors . those parameters could

probably design the predictive model yielding specificity 100% (it could properly allocate all those who will not suffer of pressure ulcer 100% correct) and 66.7% sensitivity (it could properly allocate 66.7% correct of the sample having real ulcer); with overall accuracy 92.5%, predictive value of positive test was (PVP=66.7%) and predictive value of negative test was (PVN=96.3%) and the cut off point for classifying the pressure ulcer risk was =18.

Table (6) shows that 100% of patients classified by Braden scale not to develop pressure ulcers were correct. However in stage I 86.7% was correctly classified and 13.3% falsely classified while in stage II pressure ulcers 66.7% was correctly classified and 33.3% falsely classified.

Table (7) shows that, the mean Braden scale scores of patients who did not develop a pressure ulcer were highest than those who developed it. There is significant relation between Braden scale scores and the pressure ulcer outcome for the assessment from the 1<sup>st</sup> to the 6<sup>th</sup> ( $p < 0.05$ ). While for the 6<sup>th</sup> and 7<sup>th</sup> assessment There is no significant relation between Braden scale scores and the pressure ulcer outcome ( $p > 0.05$ ). Verifies the Braden scale scoring and its value of prediction, the higher the score the less probability of development of the pressure ulcer.

**Table 6:** Classification results for Braden scale scores (n=80).

| Event         | Predicted group membership |                  |                   | Total (%) |
|---------------|----------------------------|------------------|-------------------|-----------|
|               | No P.U. (%)                | Stage I P.U. (%) | Stage II P.U. (%) |           |
| Actual count  |                            |                  |                   |           |
| No P.U.       | 53 (100%)                  | 0(0%)            | 0(0%)             | 53(100%)  |
| Stage I P.U.  | 0(0%)                      | 13(86.7%)        | 2(13.3%)          | 15(100%)  |
| Stage II P.U. | 0(0%)                      | 4(33.3%)         | 8(66.7%)          | 12(100%)  |

\* 92.5% of original grouped cases correctly classified.

\*(In the discriminant analysis we chose till the fourth reading to include most of our sample 80 patients).

**Table 7:** ANOVA test for the Braden scale scores (n=100):

| Variable         | Number of patients (n=100) | Braden scale scores |     |          |           |
|------------------|----------------------------|---------------------|-----|----------|-----------|
|                  |                            | X                   | SD  | test     | P value   |
| - 1st assessment |                            |                     |     | f= 12.46 | *p<0.05   |
| No P.U.          | 71                         | 14.7                | 3.8 |          |           |
| Stage I P.U.     | 15                         | 10.6                | 3.6 |          |           |
| Stage II P.U.    | 14                         | 10.7                | 2.5 |          |           |
| - 2nd assessment |                            |                     |     | f= 18.09 | * p <0.05 |
| No P.U.          | 71                         | 15.5                | 3.8 |          |           |
| Stage I P.U.     | 15                         | 10.6                | 3.5 |          |           |
| Stage II P.U.    | 14                         | 10.7                | 2.1 |          |           |
| - 3rd assessment |                            |                     |     | f=15.27  | * p <0.05 |
| No P.U.          | 70                         | 15.9                | 4.5 |          |           |
| Stage I P.U.     | 15                         | 11.1                | 3.8 |          |           |
| Stage II P.U.    | 14                         | 10.6                | 2.3 |          |           |
| - 4th assessment |                            |                     |     |          |           |

|                  |    |      |     |          |              |
|------------------|----|------|-----|----------|--------------|
| No P.U.          | 55 | 17.2 | 3.1 | f= 42.71 | * $p < 0.05$ |
| Stage I P.U.     | 15 | 10.8 | 3.7 |          |              |
| Stage II P.U.    | 14 | 10.6 | 2.1 |          |              |
| - 5th assessment |    |      |     |          |              |
| No P.U.          | 40 | 17.3 | 3.3 | f=31.49  | * $p < 0.05$ |
| Stage P.U.       | 10 | 11.1 | 3.6 |          |              |
| Stage II P.U.    | 13 | 10.5 | 2.2 |          |              |
| - 6th assessment |    |      |     |          |              |
| No P.U.          | 19 | 17.6 | 3.7 | f=17.49  | * $p < 0.05$ |
| Stage I P.U.     | 8  | 11.7 | 3.1 |          |              |
| Stage II P.U.    | 11 | 11.1 | 2.3 |          |              |
| - 7th assessment |    |      |     |          |              |
| No P.U.          | 8  | 16.2 | 5.2 | f= 2.54  | $p > 0.05$   |
| Stage I P.U.     | 3  | 12   | 3.6 |          |              |
| Stage II P.U.    | 8  | 11.8 | 2.8 |          |              |
| - 8th assessment |    |      |     |          |              |
| No P.U.          | 5  | 16   | 5.9 | f= 1.16  | $p > 0.05$   |
| Stage I P.U.     | 0  | 0    | 0   |          |              |
| Stage II P.U.    | 5  | 11.4 | 2.1 |          |              |

#### 4. Discussion:

Discussion of the studied sample will be presented in the following sequence: the first part of descriptive phase will be concerned with description of the socio-demographic data. The second part deals with the biomedical data and data related to pressure ulcer risk factors as gender, age, presence of significant comorbidities, and soiling; in relation to pressure ulcer outcome. The third part displays the predictive validity of the Braden scale with identification of the sensitivity, specificity, predictive value of positive (PVP) and negative (PVN) tests, the cut off point for classifying the pressure ulcer risk and percent correct for scores of the scale.

##### Part I: (Socio-demographic variables).

The majority of the study sample was found in the age group of thirty, twenty, and fifty because we deal with adult patients neither with children nor only with elderly patients. Nearly more than half of them were male whereas the rest of the study samples were female. Regarding the marital status, the majority of study sample were married, it was logic because when we deal with adults the majority of them were either married or single, also the high incidence of widow patients was between the elderly, not for adults.

Regarding the level of education and occupation the majority of patients were either can read and write or illiterate. In male patients the highest percentage for those who can only read and write, while approximately half of the female patients were illiterate so, the majority of them were housewives (most of them were from ruler areas so, they may worked at their farm), while most of the male subjects were skilled workers and followed by the incidence of

unoccupied and students' male patients . Hoeman, (2009) clarify that some relationships are not confirmed clearly, lower education level related positively with increased risk and severity of ulcers.

##### Part II: (Biomedical and risk factors data).

As regards gender, the current study findings showed that, at stage I pressure ulcer the incidence of male was the double incidence of female patients while stage II pressure ulcer, the incidence of male and female was equal. In this regards, Bergquist and Brand (2006) found in a study done to explore the risk factors associated with prevalent pressure ulcers in long-term-care patients; being male increased the risk of developing a pressure ulcer by 86%. The mechanism by which male gender was associated with pressure ulcer development was unclear.

Regarding the age, the current study findings revealed a significant difference between pressure ulcer out come and age. The highest incidence for stage I pressure ulcer was between the patients whose age ranged from 19 to 30 years and the highest incidence for stage II pressure ulcer was between those whose age ranged from 31 to 40 years .While all the patients whose age was over 70 years developed pressure ulcers, stage I and stage II. It means that, pressure ulcer may occur at any age while the elderly one the most susceptible. In the same line Cullum and Bell-Syer (2011) in their study for identifying percentage of patients with pressure ulcers that heal reported that, 70% of pressure ulcers occurring in patients over age 70 years. While Ellis (2011) in a similar study for identifying the old age, malnutrition and occurrence of pressure ulcers clarified that, energy and nutrients, such as proteins and vitamins B and C,

being deficient at old age are needed in pressure ulcer healing.

As regards the presence of significant comorbidities, the present study findings revealed a significant difference between those who had a significant comorbidities and the occurrence of pressure ulcer. Diabetic patients had a high incidence between those who developed a pressure ulcer and the incidence was increased when the diabetes was combined with hypertension. In this regards, European Pressure Ulcer Advisory Panel (2010) stated that, neuropathy, arteriosclerosis, and microvascular disease combine in diabetes, creating a high risk for pressure sores. Consequently, Saumet (2012) emphasized that, pressure ulcers are ten times more prevalent among diabetic individuals than in the general population.

In relation to soiling either from urine (urine incontinence or leak from a urinary catheter) or faeces (faeces incontinence), the present study findings revealed a significant difference between those who had soiling from urine and faeces and the occurrence of pressure ulcer. Patients had soiling from urine had a high incidence of developing a pressure ulcer while the highest incidence was between the patients having soiling from both urine and faeces. These findings supported by National Pressure ulcer Advisory Panel(2007) illustrated that soiling (whether from urine and/or faeces) alone can make the skin more susceptible to injury, soiling causes weakening of the connective tissue of the skin, making it five times as likely to become ulcerated as dry skin. Also Thompson et al. (2012) added that, problems with bladder control can greatly increase the risk of pressure sores because the skin stays moist, making it more likely to breakdown, and bacteria from fecal matter can not only cause serious local infections but also lead to life-threatening systemic complications such as sepsis, gangrene and necrotizing facilities, a severe and rapidly spreading infection.

### **Part III: (Predictive validity of the Braden scale).**

This part displays the predictive validity of the Braden scale with identification of the sensitivity, specificity, predictive value of positive (PVP) and negative (PVN) tests, the cut off point for classifying the pressure ulcer risk and percent correct for scores of the scale.

The current study findings revealed that, the Braden scale had a specificity 100% (it could properly allocate all those who will not suffer of pressure ulcer 100% correct) and 66.7% sensitivity (it could properly allocate 66.7% correct of the sample having real ulcer); with overall accuracy 92.5%, predictive value of positive test was (PVP=66.7%) and predictive value of negative test was (PVN=96.3%) and the cut off point for classifying the pressure ulcer risk was (18).

Hidalgo et al. (2013) in their study to determine the degree of validation of risk assessment scales, found that the Braden scale shows optimal validation and the best sensitivity/specificity balance (57.1%/67.5%, respectively), using the cutoff point 18. With over all accuracy 95%. On the other hand Laguzza and Holman (2007), who found in their study that, predictive validity was calculated for each cut-off, point of the scale. Using a cut-off point of 16, sensitivity was 100%. Specificity ranged from 64% to 90%. Also Halfens and Achterberg, (2007) study the validity and reliability of the Braden scale and the influence of other risk factors, showed that the original Braden scale was a reliable instrument and that the sensitivity and specificity was sufficient. A similar study done by Braden and Maklebust, (2012) about the preventing pressure ulcers with the Braden scale, showed that in terms of predictive validity, the Braden scale has demonstrated sensitivities that range from 70% to 100% and specificities ranging from 64% to 90%. While diagnostic tests must have a high degree of accuracy, it's acceptable for screening tests to have a low-to-moderate degree of accuracy. They should also be relatively inexpensive, simple, safe to administer, and acceptable to patients. The Braden scale exhibits all of these characteristics and has a moderate-to-high level of accuracy.

### **5. Conclusion:**

To sum up, it is obvious from the present study findings that the Braden scale is sufficiently valid to be used. However, it offers the best balance between sensitivity and specificity and the best risk estimate. Being able to predict which patients are at risk for pressure ulcers can assist practitioner in tailoring care to prevent unnecessary complications and suffering, as well as reduce costs.

### **6. Implications:**

The main implications of this study are directed toward the prevention of pressure ulcers after identifying the patients who are at risk.

The study shows that, the patients in different health settings are susceptible to pressure ulcers for a variety of reasons, so the nurses and caregivers on these units must apply emphasis to identify the patients at risk and to institute preventive measures quickly.

The Braden scale is a good nursing assessment tool which can be used for evaluating a patients general conditions and the risk of developing pressure ulcers. It is also easy to use in different care settings.

### **7. Recommendations:**

Based on the review of literature and findings of this study the Braden scale have a good sensitivity and specificity to be used, however, in my opinion, adding



certain factors as patient's age, presence of diabetes, preventive methods used, qualifications of caregivers, and presence of special restricted devices to the scale may enhance the specificity and sensitivity.

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