Shendi University

Faculty of Graduate Studies and Scientific Research

Assessment of impact of structured teaching program on nurse's knowledge and practice regarding pressure ulcer prevention among hospitalized patient at Almek Nimir Hospital

A thesis Submitted in requirements to fulfill Ph-D in Medical Surgical Nursing

Submitted by/

By Hawa Ibrahim Abdalla Hamid.

B.Sc Nursing – Shendi University

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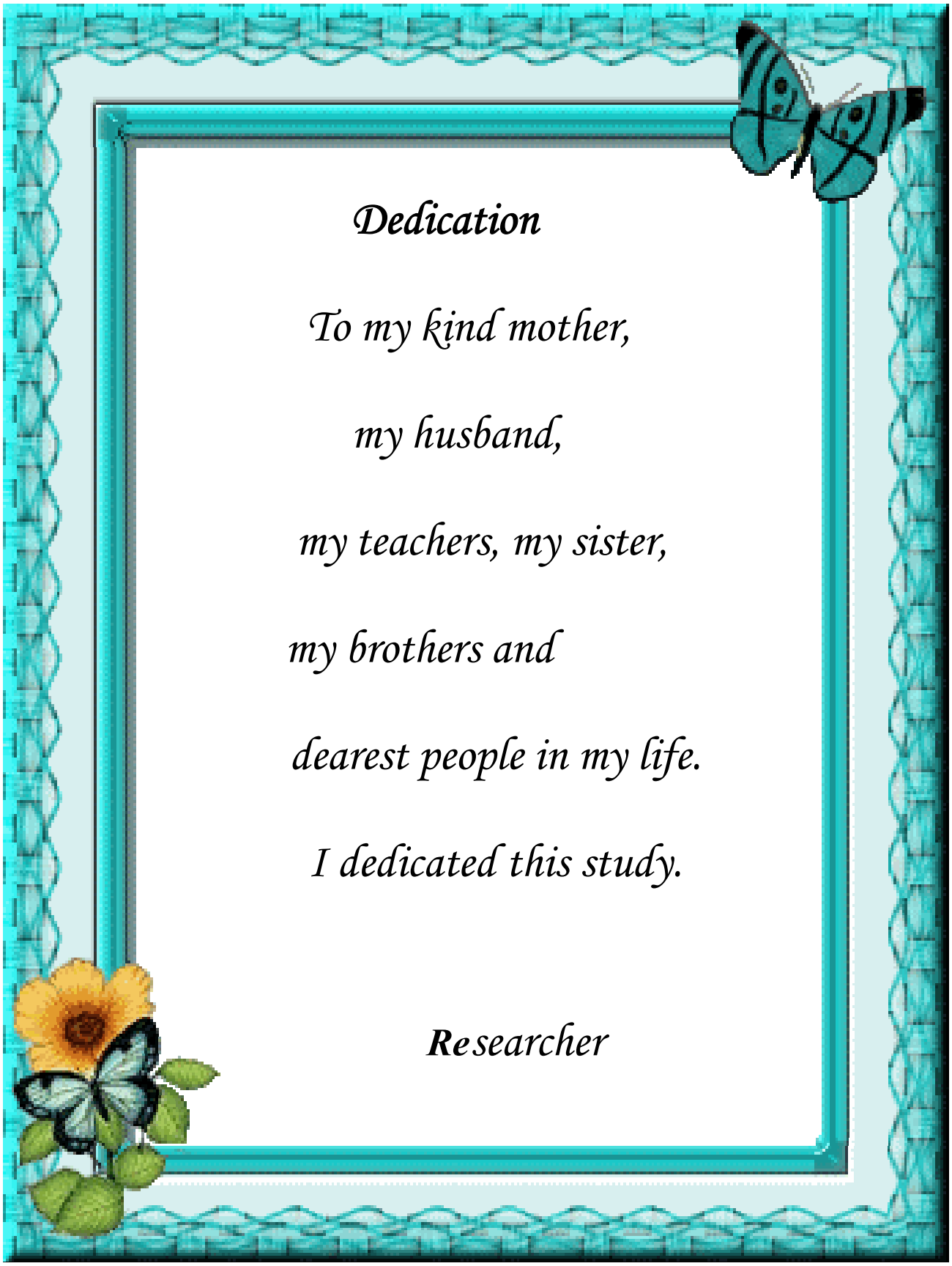
بسم الله الرحمن الرحيم

الآية

قال تعالي

" قل اعملوا فسيرى الله عملكم ورسوله والمؤمنون "

صدق الله العظيم



Dedication

To my kind mother,

my husband,

my teachers, my sister,

my brothers and

dearest people in my life.

I dedicated this study.

***Re**searcher*

Acknowledgement

To all of the following there are no words that say it all, but

"THANK YOU SO MUCH"

is ……a beginning. It gives me immense

pleasure to thank

Dr. Masaud Isaac my guide for his inspiration,

encouragement and critical suggestions at the right time.

If there is any information or words of wisdom in this work,

its due to his intense vision, keen observation

and total command

I express sincere thanks to Almek Nimir nursing staff

for their valuable help and support.

My special thanks to my friend Sit albanat Osman

For her help and encouragement

Abstract

This study was carried out at Almek Nimir university hospital in Shendi city, river Nile state, Sudan. From January 2013 to January 2014 in order to explore the impact of structured teaching program for nurses knowledge and practice regarding pressure ulcer prevention among hospitalized patient at Almek Nimir Hospital.

The sample included 96 nurses, and this refers to all nurses who were at work at Almek Nimir university hospital during the period of study. Nurses who worked as part timer, nurses with diploma certificate and nurses who were not willing to participate and those who participated in the pilot study were excluded. Quasi experimental design was used in this study. Structured interview sheet and observational checklist were used to collect data to achieve the purpose of study. An educational program was designed based on actual assessment of nurses needs; and was conducted in four sections.

The results of this study showed that nurses showing knowledge about definition of pressure ulcer in pre program test (22.9%), while the post program results showed increasing knowledge of nurses to (67.7%). And only (3.1%) of study nurses were aware about other nomenclature of pressure ulcer in preprogram testing, while their knowledge rises to (83.3%) after the interventional program.

In regards to occurrence of pressure sores from wrong method of using bedpan the study reveals that most of study group have poor knowledge about that in preprogram testing as only (16.6%), were aware about it, while their knowledge increased in post program to (63.5%).

Concerning to the nurses knowledge about first sign of pressure ulcer the study showed poor nurses knowledge about it in pre intervention testing as only (13, 5%) were aware about it, this awareness rises to (70.8%) in post intervention checking, also it showed an improvement in the nurses knowledge about appropriate scale which should be applied to assess the high

risk patients for pressure ulcer development from (13.5%) in pre interventional testing to (82.3%) after conduction of the interventional program.

There is improvement in nurses performance regarding risk assessment scale used to assess high risk patient for pressure ulcer, as there is no any nurse uses it in pre interventional testing, while (31.3%) of them used it in post interventional phase. Also there is improvement in nurses performance regarding the use of donut-shape (ring) cushion to prevent pressure ulcer formation, as there was no any nurse using it (0.00%) in the pre interventional phase, while (25%) of them always use it in post interventional phase. Furthermore there wasn't any nurse documenting patient's data related to pressure ulcer assessment in pre intervention phase compared to (47.9%) post intervention.

On conclusion, majority of study group lacked sufficient knowledge skills about pressure ulcer prevention before the interventional program and this have contributed to their inability to perform appropriate nursing care to the concerned patients. The study proved that a structured teaching program is effective in providing information and improving the skill and thereafter the performance of nurses.

Finally the study recommended an In-service training and refresher courses about pressure ulcer prevention to be designed for nurses, and the results of this study to be shared with hospital administrators and nurse administrators and concerned stakeholders.

ملخص الدراسة

أجريت هذه الدراسة بمستشفى المك نمر الجامعي بمدينة شندى , ولاية نهر النيل, السودان في الفترة من يناير 2013 إلى يناير 2014 بغرض معرفة تأثير برنامج تعليمي منظم للممرضين والممرضات على المعرفة والممارسات المتعلقة بالوقاية من قرحة السرير للمرضي المنومين بالمستشفي.

بلغت عينة الدراسة 96 ممرض وممرضة، وجميعهم يعملون بمستشفي المك نمر الجامعي خلال فترة الدراسة. وقد تم استبعاد الممرضين الممرضات الذين يعملون بصفة متعاون وحاملي شهادة الدبلوم، وكذلك الذين لا يرغبون في المشاركة والذين شاركوا في الدراسة التجريبية. استخدمت الطريقة شبة الاختيارية لإجراء هذه الدراسة حيث تم تصميم استمارة مقابلة واستمارة ملاحظة لجمع المعلومات بغرض تحقيق أهداف الدراسة, ثم تم تصميم برنامج تعليمي للممرضين والممرضات بناءا على حاجاتهم الأساسية للمعرفة والمهارة للوقاية من قرحة السرير , وتم تنفيذ هذا البرنامج على أربعة فصول.

أوضحت الدراسة أن معظم مجموعة الدراسة يفتقد للمعرفة عن التعريف الصحيح لقرحة السرير في مرحلة ما قبل تنفيذ البرنامج التعليمي, بينما أوضحت النتائج بعد تنفيذ البرنامج زيادة معرفة الممرضين إلى (67.7٪).

فقط (3.1٪) من مجموعة الدراسة كانوا على علم بالتسمية الأخرى لقرحة السرير في مرحلة ما قبل تنفيذ البرنامج التعليمي, وبعد تنفيذ البرنامج أصبح (83.3٪) من مجموعة الدراسة على علم بهذه الأسماء. في ما يخص حدوث قرحة السرير نتيجة الاستخدام الخاطئ لنونية السرير أوضحت الدراسة أن معظم مجموعة الدراسة لديهم معرفة ضعيفة عن ذلك في مرحلة ما قبل تنفيذ البرنامج التعليمي فقط (16.6٪)، كانوا على علم بذلك، في حين ازدادت معرفتهم بعد تنفيذ البرنامج إلي (63.5٪). في ما يخص معرفة مجموعة الدراسة عن أول علامات قرحة السرير فقط (13،5٪) كانوا

على علم بذلك في مرحلة ما قبل تنفيذ البرنامج التعليمي, بعد تنفيذ البرنامج ازدادت النسبة إلي (70.8٪). وأظهرت الدراسة أيضا ضعف نتيجة معرفة مجموعة الدراسة عن معيار التقييم المناسب للمرضي الأكثر عرضه لقرحة السرير في مرحلة ما قبل تنفيذ البرنامج التعليمي, فقط (13.5 ٪) كانوا على علم بذلك وأظهرت النتائج بعد التدخل ارتفاع النسبة إلى (82.3٪) .

كما أوضحت الدراسة إن مهارة مجموعة الدراسة في استخدام معيار تقييم المرضي الأكثر عرضه للإصابة بقرحة السرير, لم يكن هناك أي شخص يستخدم هذا المعيار قبل التدخل. وأظهرت الدراسة بعد التدخل زيادة في أداء مجموعة الدراسة إلى (31.3٪). كما لم يكن هناك أي شخص من مجموعة الدراسة يستخدم الوسادة الدائرية لمنع حدوث قرحة السرير في مرحلة ما قبل تنفيذ البرنامج التعليمي, بعد تنفيذ البرنامج ازدادت النسبة إلي (25٪). وعلاوة على ذلك لم يكن هناك أي شخص مجموعة الدراسة يوثق بيانات المرضى ذات الصلة بتقييم قرحة السرير قبل التدخل ، وارتفعت النسبة إلى (47.9٪) بعد التدخل.

في الختام، معظم مجموعة الدراسة تفتقر إلى المعرفة الكافية عن قرحة السرير والوقاية منها في مرحلة ما قبل تنفيذ البرنامج ، وقد ساهم ذلك في عدم قدرتهم على أداء العناية التمريضية المناسبة للمرضي . وقد أدي البرنامج التعليمي المنظم إلي توفير المعلومات وتحسين المهارات.

وتوصلت الدراسة إلي عدة توصيات تمثلت في التدريب أثناء الخدمة وعمل ودورات تنشيطية حول الوقاية من قرحة السرير. ومشاركة نتائج هذه الدراسة مع إدارة المستشفي والتمريض.

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1.1 Introduction:

The skin is an active and largest organ of the integumentary system, which completely covers the body and continuous with the mucus membranes lining_the body orifices.(1) In humans, it has multiple layers of ectodermal tissue and guards the underlying muscles, bones, ligaments and internal organs. Also it is similar to that of most other mammals, except that it is not protected by a fur. Though nearly all human skin is covered with hair follicles, it can appear hairless. There are two general types of skin, hairy and glabrous skin.(2) The adjective cutaneous literally means "of the skin" (from Latin cutis, skin). In addition, we find that the skin interfaces with the environment, so it plays a key role in protecting the body against pathogens.(3) and excessive water loss.(4) .Its other functions are insulation, sensation, synthesis of vitamin D, and excretion: sweat contains urea, hence excretion by sweating is at most a secondary function to temperature regulation.(5)

Sometimes the skin is exposed to many health problems and one of the most important of those problems is pressure ulcer. Different terminologies are used to refer to pressure ulcer, such as bed sore, decubitus ulcer and pressure sore. A pressure ulcer is an area of skin that breaks down when the client stays in one position for too long without shifting the weight. This often happens if client uses a wheel chairs or he is bedridden, even for a short period of time (for example after surgery, an injury). The constant pressure against the skin reduces blood supply to that area and the affected tissue dies.(6) The most common place for pressure ulcers are over bone prominence (bone close to the skin) like the elbow, heals, hips, ankles, shoulders, back and the occiput of the head. (7)

Maintaining skin integrity is an important independent function of nursing. Nurses must use consistent observations and skin care measures to prevent abrasions and subsequent tissue break down. Impaired skin integrity is not normally a problem in healthy people but it is a threat to the elderly and

to clients whom have restricted mobility or chronic illness. The development of a pressure ulcer adds to a client's recovery time and costs. It is estimated that a pressure ulcer can increase the cases of nursing care by 50%.[8]Also It was estimated that 60,000 deaths occurred each year in the United States of America due to pressure ulcer related complications.[9] Another study estimated that the incidence of pressure ulcer in acute care settings ranged from 2.2% to 66% in the United Kingdom and from 0% to 65.6% in the United States of America and Canada respectively.[10]

Each year, more than 2.5 million people in the United States develop pressure ulcers. In acute care settings in the United States, the incidence of bedsores is 0.4% to 38%; within long-term care it is 2.2% to 23.9%, and in home care, it is 0% to 17%.[11] Similarly, there is wide variation in prevalence: 10% to 18% in acute care, 2.3% to 28% in long-term care, and 0% to 29% in home care. [12]

The incidence of pressure ulcer in Asian countries was considered high ranging from 2.1% to 31.3% in intensive care unit.[13] No similar study was conducted on that regard in Sudan.

Some reasons for the high incidence of pressure ulcer might be related to nurses' knowledge and practice in terms of risk assessment and prevention methods. Knowledge, attitude, and practice increased nurses' awareness of the problem of pressure ulcer and provided the basis for informed decision making and the framework to develop and maintain competency of delivering high quality of nursing care.[14]

1.2. Rationale

"A sound skin makes person feel good and look good". Healthy skin is often an indicator of people holistic wellness. Healthy skin is sign of good overall health. Some skin changes can signal a health problem. For instance, a "butterfly" rash on the face can be a sign of lupus. Distinct rashes appear with some viruses, such as the measles and chicken pox. An allergic reaction can cause hives, redness, and itching. Diabetes and thyroid disease can cause hair loss. Knowing how the skin normally look and feel will help people to notice changes to ask their doctor about.

It is unnecessary to reiterate that pressure ulcers have a profound impact on the overall wellbeing of patients and their environment. Pain, a changed body image, increased immobility; discomfort, the loss of independence and the loss of self-control are reported frequently. Pain contributes to sleep disturbance, negatively impacts mood, and creates feelings of anxiety. Emotions such as powerlessness, worrying, depression and worthlessness are described by patients. Pressure ulcers may lead to serious complications, prolonged hospitalization, and even death. Also Pressure ulcer has a significant financial burden on any health care system and had adverse effects on achieving goals of care it increased use of hospital resources and patient care costs, increased patients length of hospital stay and increased cost of pharmaceuticals.[15]

Lack of knowledge and skills in pressure ulcer prevention contributes significantly to the occurrence or worsening of pressure ulcer; therefore, nurses require regular training and education in this area of practice. Moreover, increased knowledge about pressure ulcer prevention among nurses not only improves the quality of pressure ulcer care but also reduces hospital stays, and the number of patients suffering from this condition.[16]

Prevention of the pressure sore has been a nursing concern for many years. Although the prevention of pressure ulcers is a multidisciplinary responsibility,

nurses play a major role in preventing it. Most pressure sores are preventable and are caused by faulty care.[17]

Nurses have a duty to monitor patient skin in order to plan, implement, and evaluate interventions that maintain skin integrity. Work quality has been found to be related to the knowledge they have in this field.[18]

Nurse is one of the health team members who act as a facilitator and supporter in increasing the potential abilities of the patients. They play a major role in quality care if they receive latest and adequate information and they are able to contribute more to the patient's well being. Nurses can provide physiological and psychological support to the patients. They are perceived to be more valuable than other members of the health care team due to the fact that the nurses work round the clock at the bedside of the patients. Knowledge and clear understanding of the disease and precautionary measures help to prevent the complications.

Because of the above mentioned reasons there is a need for conducting a planned teaching program to prevent the development of bedsores among immobilized patients.

1.3. Aims of the Study

General objective:-

To reduce the incidence of pressure ulcer among patients admitted at Almek Nimir university Hospital

Research question:

Is the nurses Knowledge and practice at the required level to prevent the development of pressure ulcers in Almek Nimir university Hospital?

Specific objective:-

- To assess the level of nurses' knowledge regarding pressure ulcer and its prevention.
- To identify the level of nurses' practice regarding pressure ulcer prevention.
- To develop a teaching program for nurses about pressure ulcer and its prevention.
- To assess the level of nurses' post structured teaching program knowledge and practice regarding pressure ulcer prevention.
- To determine the impact of structured teaching program regarding pressure sores and its prevention in terms of improved nurses practice.

2. Literature review

2.1. Anatomy and physiology of the skin:

The human skin is the outer covering of the body, in direct contact with the outside environment. It is the largest organ of the integumentary system. For the average adult human, the skin has a surface area of 1.5-2.0 square meters, most of it between 2–3 mm thick.[19]

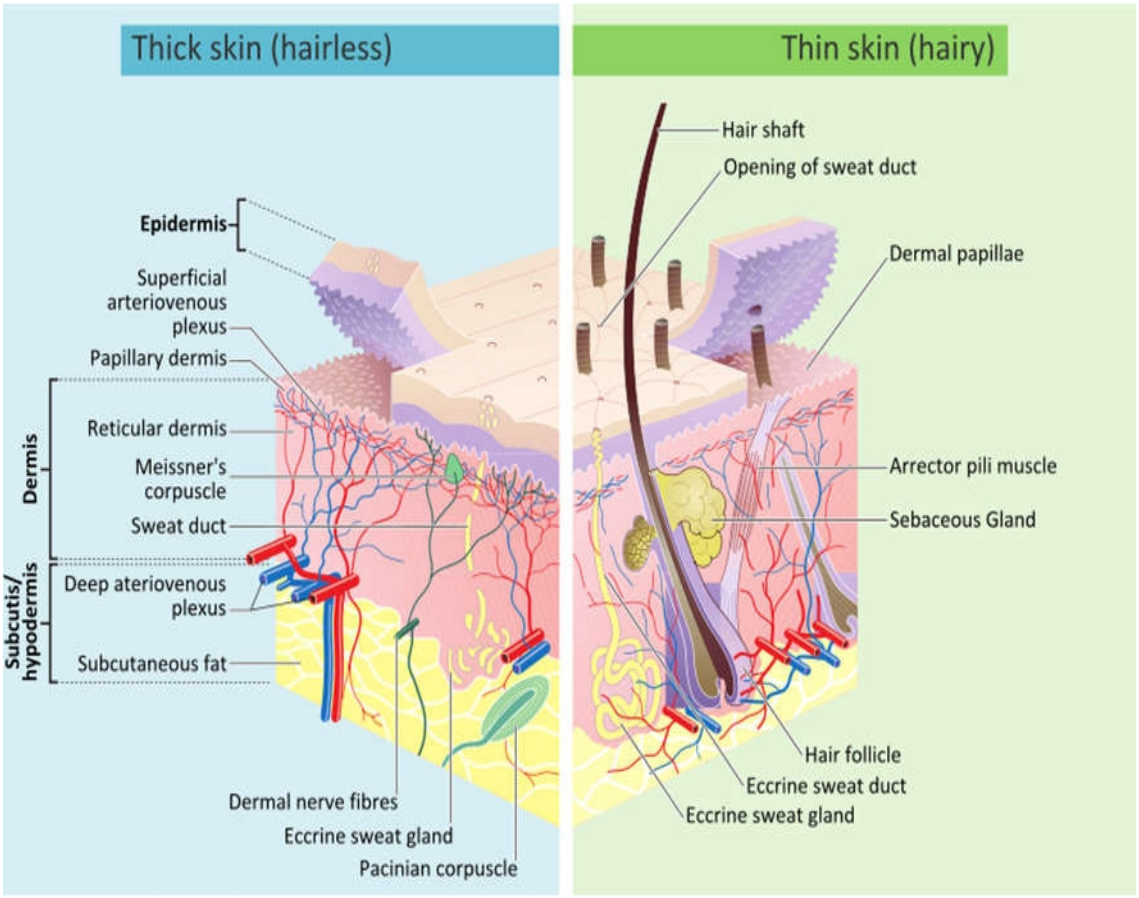


Figure 1: skin layer to both hairy and hairless skin

Skin layers:

The skin is composed of three primary layers:

1. Epidermis:

The **epidermis** is composed of the outermost layers of cells in the skin, "epi" in Greek meaning "over" or "upon", which together with the dermis forms the cutis.

The epidermis is stratified squamous epithelium, composed of proliferating basal and differentiated suprabasal keratinocytes which acts as the body's major barrier against an inhospitable environment, by preventing pathogens from entering, and this making the skin a natural barrier to infection. It also regulates the amount of water released from the body into the atmosphere through transepidermal water loss (TEWL). Also the epidermis contains melanocytes, langerhans cells and merkel cells. The epidermis varies in thickness from 0.05 mm on the eyelids to 0.8-1.5 mm on the soles of the feet and palms of the hand.(4)

The epidermis is divided into two zones, the horny and the germinal zone.

a. **The horny zone is subdivided into 3 layers:**

- ✓ Stratum Corneum, (Latin for 'horned layer'). The outer layer of the skin Composed of 10 to 30 layers of polyhedral, anucleated corneocytes (final step of keratinocyte differentiation), surrounded by a protein envelope, filled with water-retaining keratin proteins, attached together through corneodesmosomes and surrounded in the extracellular space by stacked layers of lipids. Most of the barrier functions of the epidermis localize to this layer. with the palms and soles having the most layers.(20)
- ✓ The stratum lucidum (Latin for "clear layer") is a thin, clear layer of dead skin cells in the epidermis named for its translucent appearance under a microscope. It is readily visible by light microscopy only in areas of

thick skin, which are found on the palms of the hands and the soles of the feet. it is composed of three to five layers of dead, flattened keratinocytes.[21]

- ✓ Stratum Granulosum. (or granular layer) is a thin layer of 2 to 3 cells in the epidermis.

b. The germinal zone is subdivided into 2 layers classed as:

- ✓ Stratum Spinosum is a layer of the epidermis found between the stratum granulosum and stratum basale. This appearance is due to desmosomal connections of adjacent cells. This layer is composed of polyhedral keratinocytes(8-10 rows.) [21]
- ✓ Stratum basal (basal layer, sometimes referred to as stratum germinativum) is the deepest layer of the five layers of the epidermis, which is the oute rcovering of skin in mammals. The stratum basal is a continuous layer of cells. It is often described as one cell thick, though it may in fact be two to three cells thick in glabrous (hairless) skin. Other types of cells found within the stratum basale are melanocytes (pigment-producing cells), Langerhans cells (immune cells), and Merkel cells (touch receptors).[20,21]

The epidermis is separated from the dermis, its underlying tissue, by a basement membrane. Abnormalities here result in the expression of rare skin diseases such as bullous pemphigoid. [20,21]

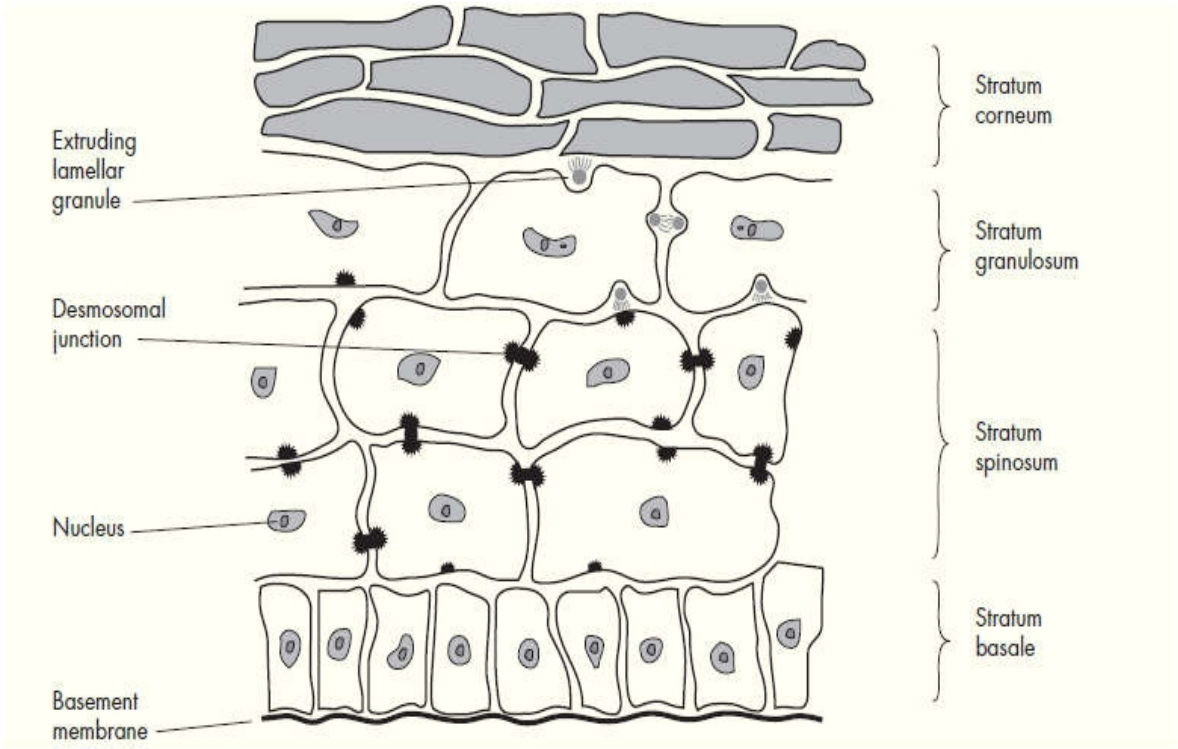


Figure 2: Layers of the epidermis

2. **Dermis:**

The dermis is the layer of skin beneath the epidermis that consists of connective tissue and cushions the body from stress and strain. The dermis is tightly connected to the epidermis by a basement membrane. It also harbors many nerve endings that provide the sense of touch and heat. It contains the hair follicles, sweat glands, sebaceous glands, apocrine glands, lymphatic vessels and blood vessels. [19]

The dermis is structurally divided into two areas: a superficial area adjacent to the epidermis, called the papillary region, and a deep thicker area known as the reticular region.

a. The papillary region is composed of loose connective tissue. It is named for its fingerlike projections called papillae that extend toward the epidermis. The papillae provide the dermis with a "bumpy" surface that

interdigitates with the epidermis, strengthening the connection between the two layers of skin. [20]

b. **The Reticular region** – The reticular region lies under the papillary region and is usually much thicker. It is composed of dense irregular connective tissue, and receives its name from the dense concentration of collagenous, elastic, and reticular fibers that weave throughout it. These protein fibers give the dermis its properties of strength, extensibility, and elasticity. Also located within the reticular region are the roots of the hair, sebaceous glands, sweat glands, receptors, nails, and blood vessels.[22]

The dermis holds many structures, which are needed to complete the skins functions.

A. **Capillary blood vessels**, there is a vast network of capillaries throughout the dermis known as the blood reservoir it holds 8 to 10% of the body's blood. Without this the skin could not complete its function of temperature regulation. The epidermis is also fed from this supply. .[22]

B. **Lymphatic vessels** which carry interstitial fluid back to the blood, for elimination. .[22]

C. **Nerve supply:** The skin has a rich innervation with the hands, face and genitalia having the highest density of nerves. All cutaneous nerves have their cell bodies in the dorsal root ganglia. Free sensory nerve endings lie in the dermis where they detect pain, itch and temperature. Specialized corpuscular receptors also lie in the dermis allowing sensations of touch to be received by Meissner's corpuscles and pressure and vibration by Pacinian corpuscles. The autonomic nervous system supplies the motor innervation of the skin: adrenergic fibres innervate blood vessels, hair erector muscles and apocrine glands while cholinergic fibres innervate eccrine sweat glands. The endocrine system regulates the sebaceous glands, which are not innervated by autonomic fibres.[23]

D. Sweat glands: (also known as sudoriferous or sudoriparous glands, from Latin sudor, meaning "sweat"), There are two main types of sweat glands:

- ✓ Eccrine sweat glands are distributed almost all over the body, though their density varies from region to region. Eccrine sweat glands are smaller than apocrine sweat glands, and they do not extend as deep into the dermis. Eccrine sweat glands discharge their secretions directly onto the surface of the skin.[23] Eccrine glands have three primary functions:

1. Thermoregulation. Sweat cools the surface of the skin and reduces body temperature. [24]
2. Excretion. Eccrine sweat gland secretion can also provide a significant excretory route for water and electrolytes.
3. Protection. Eccrine sweat gland secretion aids in preserving the skin's acid mantle, which helps protect the skin from colonisation from bacteria and other pathogenic organisms. [24]

- ✓ Apocrine glands are larger, the ducts of which empty out into the hair follicles. They are present in the axillae and genital region and are under thermal control. They become active at puberty, producing an odourless protein-rich secretion which when acted upon by skin bacteria gives out a characteristic odour. [24]

E. The sebaceous glands are microscopic exocrine glands in the skin that secrete an oily or waxy matter, called sebum, to lubricate and waterproof the skin and hair of mammals. In humans, they are found in the greatest number on the face and scalp, and are also found on all parts of the skin except the palms of the hands and soles of the feet.[25] The full function of sebum is unknown at present but it does play a role in the following:

- ✓ Maintaining the epidermal permeability barrier, structure and differentiation. .[25]

- ✓ Transporting antioxidants to the skin surface. [25]
- ✓ Protection from UV radiation. [25]

F. Hair can be found in varying densities of growth over the entire surface of the body, exceptions being on the palms, soles and glans penis. Follicles are most dense on the scalp and face and are derived from the epidermis and the dermis.. The hair shaft consists of an outer cuticle, a cortex of keratinocytes and an inner medulla. The root sheath, which surrounds the hair bulb, is composed of an outer and inner layer. An erector pili muscle is associated with the hair shaft and contracts with cold, fear and emotion to pull the hair erect, giving the skin `goose bumps'. [19]

G. Nails: is a horn-like envelope covering the dorsal aspect of the terminal phalanges of fingers and toes in humans. Consist of a dense plate of hardened keratin between 0.3 and 0.5mm thick. A healthy finger nail has the function of protecting the distal phalanx, the fingertip, and the surrounding soft tissues from injuries. [19]

Parts of the nail:

- ✓ **Nail plate:** is the hard part of the nail, made of translucent keratin protein. Several layers of dead, compacted cells cause the nail to be strong but flexible. Its (transverse) shape is determined by the form of the underlying bone. In common usage, the word nail often refers to this part only. [19]
- ✓ **Lunula ("small moon"):** is the visible part of the matrix, the whitish crescent-shaped base of the visible nail. The lunula can best be seen in the thumb and may not be visible in the little finger.
- ✓ **Nail sinus (sinus unguis):** is where the nail root is i.e. the base of the nail underneath the skin. It originates from the actively growing tissue below (the matrix). [19]
- ✓ **Nail matrix:** is the formative layer of cells at the base of the fingernail or toenail. This tissue consists of rapidly dividing skin cells that soon fill with the protein keratin. The matrix of finger nails consists of the most rapidly

dividing skin cells in the body, which grows four times faster than toenails at a rate of about 3 mm a month.

- ✓ **Nail bed:** is the skin beneath the nail plate. Like all skin, it is made of two types of tissues: the deeper dermis, the living tissue which includes capillaries and glands, and the epidermis, the layer just beneath the nail plate, which moves toward the finger tip with the plate. The epidermis is attached to the dermis by tiny longitudinal "grooves" called matrix crests. In old age, the nail plate becomes thinner, and these grooves become more visible. [19]
- ✓ **Free margin or distal edge:** is the anterior margin of the nail plate corresponding to the abrasive or cutting edge of the nail.
- ✓ **Hyponychium (informally:** is the epithelium located beneath the nail plate at the junction between the free edge and the skin of the fingertip. [19]

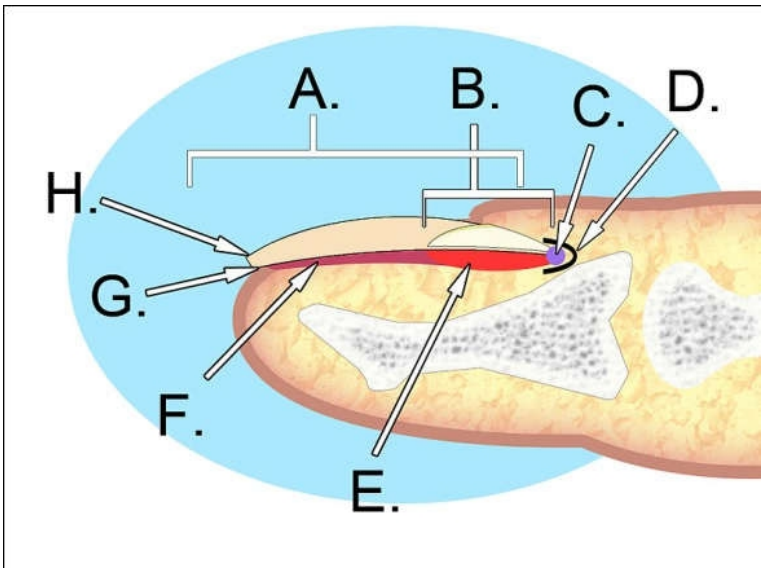


Figure 3: nail parts

A. Nail plate; B. lunula; C. root; D. sinus; E. matrix; F. nail bed; G. hyponychium; H. free margin

3. Subcutis

This is made up of loose connective tissue and fat, which can be up to 3 cm thick on the abdomen. It contains larger blood vessels and nerves than those found in the dermis. .(19)

2.2 Skin functions:

Skin performs the following functions:

1. Protection: an anatomical barrier from pathogens and damage between the internal and external environment in bodily defense; Langerhans cells in the skin are part of the adaptive immune system.[3]
2. Sensation: contains a variety of nerve endings that react to heat and cold, touch, pressure, vibration, and tissue injury. .[23]
3. Heat regulation: the skin contains a blood supply far greater than its requirements which allows precise control of energy loss by radiation, convection and conduction. Dilated blood vessels increase perfusion and heat loss, while constricted vessels greatly reduce cutaneous blood flow and conserve heat. .[5]
4. Control of evaporation: the skin provides a relatively dry and semi-impermeable barrier to fluid loss. Loss of this function contributes to the massive fluid loss in burns. .[4]
5. Storage and synthesis: acts as a storage center for lipids and water, as well as a means of synthesis of vitamin D by action of ultraviolet radiation on certain parts of the skin. .[4]
6. Excretion: sweat contains urea, however its concentration is 1/130th that of urine, hence excretion by sweating is at most a secondary function to temperature regulation. .[25]
7. Absorption: the cells comprising the outermost 0.25–0.40 mm of the skin are "almost exclusively supplied by external oxygen", although the "contribution to total respiration is negligible". In addition, medicine can be administered through the skin, by ointments or by means of adhesive patch, such as the nicotine patch. .[25]
8. Water resistance: The skin acts as a water resistant barrier so essential nutrients aren't washed out of the body. .[4]

2.3. Skin aging:

Skin aging is a complex process that defines the changes observed throughout the lifespan and cannot be defined by a single pathway or a single cause. Aging is controlled by both environmental factors and the genetic constitution of the individual. [26]

Causes and Effects

1. Intrinsic aging is also called chronologic aging influenced by internal physiological factors alone. It is sometimes referred to degenerative process due to declining of physiologic functions and capacities. Such an aging process may include qualitative and quantitative changes and includes diminished or defective synthesis of collagen and elastin in the dermis. [26]
2. Extrinsic aging is most often referred to as photoaging. it is a distinctive declination process caused by external factors, which include ultra-violet radiation, cigarette smoking, air pollution, among others. Of all extrinsic causes, radiation from sunlight has the most widespread documentation of its negative effects on the skin. Because of this, extrinsic aging is often referred to as photoaging. [26]

A recent consensus forum of the American Academy of Dermatology concluded that the majority of undesirable clinical features associated with 'skin ageing' are the result of damage to skin due to UV radiation (photoageing). Clinically photoageing is characterized by coarseness, wrinkling, mottled pigmentation, laxity, telangiectasia, and premalignant and malignant neoplasms. Appropriate lifelong use of sunscreens may minimize many of the changes associated with photoageing.[27]

2.4. Introduction to pressure ulcer:

Pressure ulcers have been a nursing concern for many years. In fact, Florence Nightingale in 1859 wrote, “If he has a bedsore, it’s generally not the fault of the disease, but of the nursing”. Others view pressure ulcers as a “visible mark of caregiver sin” associated with poor or nonexistent nursing care. Many clinicians believe that pressure ulcer development is not simply the fault of the nursing care, but rather a failure of the entire heath care system -hence, a breakdown in the cooperation and skill of the entire health care team (nurses, physicians, physical therapists, dietitians, etc.). Although the prevention of pressure ulcers is a multidisciplinary responsibility, nurses play a major (or central) role.[18 -28]

Pressure ulcer prevention is one of the quality indicators to reduce the incidence of pressure ulcer. It achieved by development and implementation of pressure ulcer prevention protocol, educating staff, formation of quality improvement team, and improve the nursing steps in assessing the risk factor and assess nutritional status, providing skin care, and documenting the data.[29]

2.5 Definition of pressure ulcer:

Pressure ulcers, also known as decubitus ulcers or bedsores, it is localized injuries to the skin and/or underlying tissue that usually occur over a bony prominence as a result of pressure, or pressure in combination with shear and/or friction. The most common sites are the sacrum, coccyx, heels or the hips, but other sites such as the elbows, knees, ankles or the back of the cranium can be affected.[30]

2.6 Causes of pressure ulcer:

Main causes:

There are four main factors implicated in the occurrence of pressure ulcers (pressure, shear force, friction and moisture, with pressure being the most important etiological factor).[30]

The most important determinants of pressure ulcers are the intensity and duration of pressure and the tissue tolerance for pressure.[31] Greater degree and longer duration of shearing and compressive forces between bony prominence and external surface cause damage to the tissue.[32] Tissue tolerance is defined as the ability of the skin and underlying structures to tolerate pressure. Tissue tolerance for pressure is influenced by both extrinsic and intrinsic factors. Most studies classified the risk factors for pressure ulcer development as an extrinsic and intrinsic factors.[33]

Extrinsic factors:

Extrinsic factors are external factors that damage the skin resulting in pressure ulcer formation. Pressure, shear and friction, and skin moisture were listed to be as extrinsic factors for pressure ulcer formation. [34]

1. **Pressure……** the perpendicular (compression) force exerted on the skin by gravity. If external pressure is greater than capillary perfusion pressure, then there is vascular compression resulting in tissue ischemia. Normal capillary filling pressure is approximately 32 mmHg at the arteriolar end

and 12 mmHg at the venous end.[35]. External pressure greater than 32 mmHg may cause tissue damage by restricting blood flow to the area. Continued pressure on soft tissue causes capillaries to collapse and forms thrombi. Thus, cells die due to impaired oxygenation and nutrients to the affected area and accumulation of waste products in the tissue.[36,37] A low pressure over bony prominences for a long duration has a detrimental effect towards tissue at a high pressure for a shorter duration.[38]

2. **Shear:……** is the result of parallel force to the skin surface which affects blood supply that leads to ischemia, cellular death, and necrosis.[38] It is affected by the amount of pressure exerted, the coefficient of friction between the support surface materials and body surface contacting each other, and the extent to which the body makes contact with the support surface.[39] Elevating the head of the bed increases shear and pressure in the sacral and coccygeal areas. Shear is greatest when a caregiver drags a patient along with the surface of the sheet during repositioning or from wrong method of using the bedpan or allows the patient to slide down from high fowler's position. Then shearing forces cause triangular shaped sacral ulcer with tunneling or deep sinus track.[40]
3. **Friction:…….** is the force of two surfaces moving across one another.[40] The bed linen may run away from the support surface when a patient was dragged during lying on the bed causing friction force. When the interface between body and bedding is moist caused by perspiration, incontinence, or wound exudates, the coefficient of friction and shearing rises sharply.[40] If the head of the bed is high, gravity pulls the skeleton downward, and the friction and shearing forces cause necrosis in the sacral area. Friction causes skin damage to the epidermal and dermal layer in the patients who are restless.[32] Movement over rough surface weakens the barrier to friction and shearing caused to the outer layers of the skin slide

with rough or sticky surfaces, pulling and potentially tearing underlying tissues.[31]

4. **Maceration**:… … … the incontinence, sweating, or leaking wounds were the possible risk factors for patients admitted in ICU unit. Exposure to moisture in the form of urine, feces, perspiration, and drainage from fistula or wound for prolonged period reduces the resistance of the skin of other forces such as friction. [32]

Intrinsic factors:

1. **Advance age:**… … … The elderly are at an increased risk of developing pressure ulcers, with a cumulative incidence for pressure ulcers of a Stage II severity or higher being estimated at 12.9% in elderly people hospitalized for periods of up to 8 weeks for an acute event.[41] However, it is not old age itself that predisposes an individual to pressure ulcers, but rather problems common in the elderly that are associated with pressure ulceration. Hip fractures, fecal and urinary incontinence, smoking, dry skin, chronic systemic conditions, malnutrition and terminal illnesses, all these predispose for pressure ulcer development.[42] In addition to contributing towards immobility, acute or chronic illnesses increase metabolic rate and oxygen demand, thus compromising tissue healing ability. Sensory impairment, due to neuropathies can also diminish the ability to perceive pain and discomfort associated with prolonged pressure, leading to a reduced frequency of repositioning. [42]

2. **Malnutrition:**… … … Inadequate protein or poor energy intake and recent weight loss have been identified as independent risk factors for the development of pressure ulcers.[43, 44] It has been shown that several indices of malnutrition are associated with the risk of developing pressure ulcers, with many investigators finding a relationship between wound healing and body weight, body mass index, low serum

albumin and zinc and total protein levels.[44,45] Prospective studies comparing pressure ulcer development in nourished and malnourished patients show a higher incidence of pressure ulcers in the malnourished patients, thus arguing for a case of nutrition support in this patient group.[46]

3. **Sensory perception**:… … … Is an ability to perceive pain or discomfort or seeking for assistance for changing position.[31] Impaired sensory perception is the person's inability to feel or perceive or recognize pressure or discomfort. Patients with spinal cord injury, patients with cerebro-vascular disease, and patients with diabetes mellitus are example of patients who have impaired sensory perception. Therefore, those groups of individual are at risk for pressure ulcer development.[47]
4. **Impaired blood circulation:**… … … Is another intrinsic risk factor for pressure ulcer's development. Systolic blood pressure below 100 mmHg and diastolic pressure below 60 mmHg were related to pressure ulcer formation.[48] Hypotension prevents blood flow from the skin to vital organs resulting in skin intolerance for pressure. Paraplegic and geriatric patients had lower blood flow in the ischeal tuberosity during sitting up on an unpadded surface than in normal patients.[34]
5. **Smoking:**… … …long term exposure to compounds found in the smoke (e.g., carbon monoxide and cyanide) are believed to be responsible for pulmonary damage and for loss of elasticity in the alveoli, leading to emphysema and chronic obstructive pulmonary disease caused by smoking, is a permanent, incurable (often terminal) reduction of pulmonary capacity characterised by shortness of breath, wheezing, persistent cough with sputum, and damage to the lungs, including emphysema and chronic bronchitis. [49] Also Inhalation of tobacco smoke causes several immediate responses within the heart and blood vessels. Within one minute the heart rate begins to rise, increasing

by as much as 30 percent during the first 10 minutes of smoking. Carbon monoxide in tobacco smoke exerts its negative effects by reducing the blood's ability to carry oxygen. Both of these conditions can become permanent with prolonged use of cigarettes. Smoking also increases the chance of heart disease, stroke, atherosclerosis, and peripheral vascular disease.[50]

Beside increases the risk of heart, vascular disease and chronic lung disease, the negative effects of smoking on wound-healing outcomes have been known for a long time.[51] Nicotine probably interferes with oxygen supply by inducing tissue ischemia, since nicotine can cause decreased tissue blood flow via vasoconstrictive effects.[52] Nicotine stimulates sympathetic nervous activity, resulting in the release of epinephrine, which causes peripheral vasoconstriction and decreased tissue blood perfusion. In addition to the effects of nicotine, carbon monoxide in cigarette smoke also causes tissue hypoxia. Carbon monoxide aggressively binds to hemoglobin with an affinity 200 times greater than that of oxygen, resulting in a decreased fraction of oxygenated hemoglobin in the bloodstream. Hydrogen cyanide component of cigarette smoke, impairs cellular oxygen metabolism, leading to compromised oxygen consumption in the tissues. Beyond these direct tissue effects, smoking increases the individual's risk for atherosclerosis and chronic obstructive pulmonary disease, two conditions that might also lower tissue oxygen tension.[51]

6. **Temperature:**… … … Both skin and core temperatures have been examined. Skin temperature elevation has been associated with pressure ulcer development in several studies.[53,54] while elevated core (body) temperature was found to be a risk factor in the prospective nursing home study of Bergstrom and Braden.[55] The association has not been fully explained; however, it may be related to increased oxygen demand. With each degree centigrade rise in temperature there is an increase in

tissue metabolism and oxygen demand of 10 per cent.[54] Pressure-relieving cushions have been shown to lower skin temperature.[55] but no prospective studies have examined the effect of lowering skin temperature on pressure ulcer development

7. Health conditions:… … … there are many health conditions that can make the patient more vulnerable to pressure ulcers include:

1. Diabetes can cause damage to the nerves throughout Prolonged exposure to high blood sugar which damage the nerve fibers, causing diabetic neuropathy. Why this happens isn't completely clear, but a combination of factors likely plays a role, including the complex interaction between nerves and blood vessels (high blood sugar interferes with the ability of the nerves to transmit signals. It also weakens the walls of the small blood vessels (capillaries) that supply the nerves with oxygen and nutrients). Nerve damage (peripheral neuropathy) lead to loss of feeling. Loss of feeling is particularly important because it can allow injuries to go unnoticed, leading to serious infections.[56] also Diabetes mellitus causing endothelial and smooth muscle cell dysfunction in peripheral arteries lead to Peripheral arterial disease.[57]
2. Heart failure is a condition in which the heart does not pump enough blood to meet the needs of the body's tissues, this condition also lead to decreased the oxygen supply to the skin and activity intolerance and restrict patients mobility.[58] Also right heart failure lead to congestion of the viscera and the peripheral tissues predominantly because the right side of the heart cannot eject blood and cannot accommodate all the blood that normally returns to it from the venous circulation. The increase in venous pressure leads to edema of the lower extremities, it can gradually progress up the legs and thighs and eventually into the

external genitalia and lower trunk. And it lead to impaired skin integrity and ulcer.[59]

3. Kidney failure leads to anemia due to reduced erythropoietin production, uremic gastrointestinal lesions, reduced red blood cells life span, and blood loss, usually from the gastrointestinal tract. With use of the parenteral form of erythropoietin (Epogen), also anemia can occur due to regular dialysis and this lead to decrease blood and oxygen to meet the needs of the body's tissues.[60] Also kidney failure lead to excess fluid volume related to decreased urine output, and this lead to impaired skin integrity.[61]

8. Mobility problems:… … … Because the development of pressure ulcers depends on the length of time that pressure is applied, immobility is the major risk factor. Healthy, active people can develop pressure ulcer when anesthesia, sedation, disease, or injury renders them immobile and causes decreased pain perception.[62] Although all patients who are bed- or chair-bound have some degree of mobility impairment, the severity ranges from complete immobility to the ability to reposition independently. Patients may not reposition themselves because they cannot move or cannot sense the discomfort associated with immobility. Patients who cannot move include those with spinal cord injury, various fractures, Parkinson's disease, stroke, severe pain, rheumatoid arthritis and conditions associated with severe illness and post surgery. Physical restraints, used in the bed or chair, contribute to impaired movement and also may directly cause pressure.[63] Examples of sensory loss that impair sensing the need to reposition include peripheral neuropathy, spinal cord injury, stroke, and coma from any cause (including medically-induced sedation and/or paralysis). Although inability to move and inability to sense the need to move are separated in these examples, it is more common to find patients who have both immobility and sensory loss, such

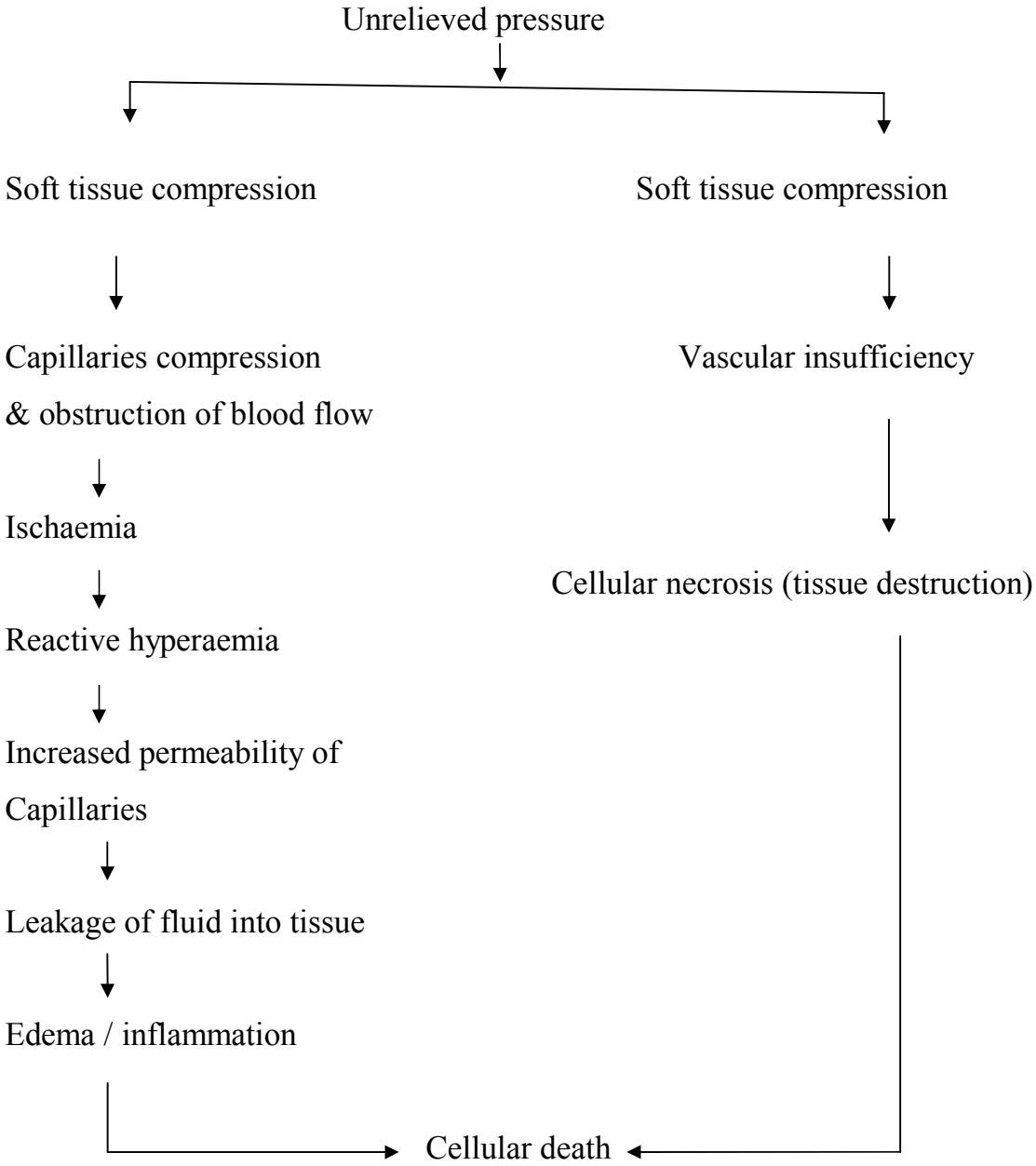
as a ventilated patient with who is receiving intravenous analgesia and sedation.[62] Not surprisingly, spontaneous nocturnal movements during sleep can prevent ulcer development; data indicate that elderly persons with more than 50 nocturnal movements did not develop ulcers, whereas 90% of those with fewer than 20 developed at least a single ulcer. [63]

9. **Mental health conditions**:… … … People with severe mental health conditions such as schizophrenia (a condition where people have problems telling the difference between reality and imagination) or severe depression have an increased risk of pressure ulcers for a number of reasons: (their diet tends to be poor, they often have other physical health conditions, such as diabetes or incontinence, they may neglect their personal hygiene, making their skin more vulnerable to injury and infection. [64]

Based on above mentioned discussion, it is concluded that, pressure, shear, friction and maceration were found to be important extrinsic factors for pressure ulcer development. In addition, immobility, decreased activity, malnutrition, advanced age, impaired sensory function, impaired blood circulation, were considered as intrinsic risk factors for pressure ulcer development. Therefore, nurses need to have knowledge of the Pathophysiology for pressure ulcer development and its contributing factors in order to perform risk assessment and preventive care. These types of knowledge can enhance the nurses' performance of identifying an individual at risk for pressure ulcer development.

2.7 Pathophysiology of pressure ulcer:

There are currently two major theories about the development of pressure ulcers. The first and most accepted is the deep tissue injury theory which claims that the ulcers begin at the deepest level, around the bone, and move outward until they reach the epidermis. The second, less popular theory is the top-to-bottom model which says that skin first begins to deteriorate at the surface and then proceeds inward.[65] The development of a pressure ulcer is a complex process that requires the application of external forces to the skin. However, external forces alone are not sufficient to cause an ulcer, rather the interaction of these forces with host-specific factors is what ultimately leads to tissue damage.[66] In susceptible patients, the combination of immobility and extended periods of pressure or friction over bony prominences leads to reduced capillary blood flow, tissue hypoxia, and ischemic tissue injury. This in turn evokes an inflammatory response and localized edema that further impairs perfusion and augments soft tissue and skin injury. Current understanding favors a "bottom-up" model of tissue damage beginning deep in the muscle layer. Muscle is more sensitive to pressure injury than skin because it is the more metabolically active layer and thus more susceptible to ischemic injury.[67]


Unrelieved pressure
Soft tissue compression
Soft tissue compression
Capillaries compression
& obstruction of blood flow
Vascular insufficiency
Ischaemia
Cellular necrosis (tissue destruction)
Reactive hyperaemia
Increased permeability of
Capillaries
Leakage of fluid into tissue
Edema / inflammation
Cellular death

2.8. Common sites of pressure ulcer:

Although pressure ulcers can develop at any site, they occur more frequently over bony prominences, as previously suggested. Patient position and degree of immobility can influence the site of involvement. The most common locations are the sacrum, coccyx, and heels (when persons are in a supine position); the hips and ankles (when persons are lying on their sides); and the buttocks (when persons are seated). Less commonly involved are the earlobes, occiput, chin, elbow, scapula, and knee. The lower half of the body accounts for 95% of pressure ulcers.[68,69] According to Whittington K, Patrick M, Roberts JL study, the most common sites for ulcer development are the sacrum and coccyx, accounting for 26% and 31%, respectively.[70]

Common sites pressure ulcer on lateral position:

Heel, lower leg, medial knees, greater trochanter, shoulder, ankle and foot edge, Humerous (obscured) and ears.

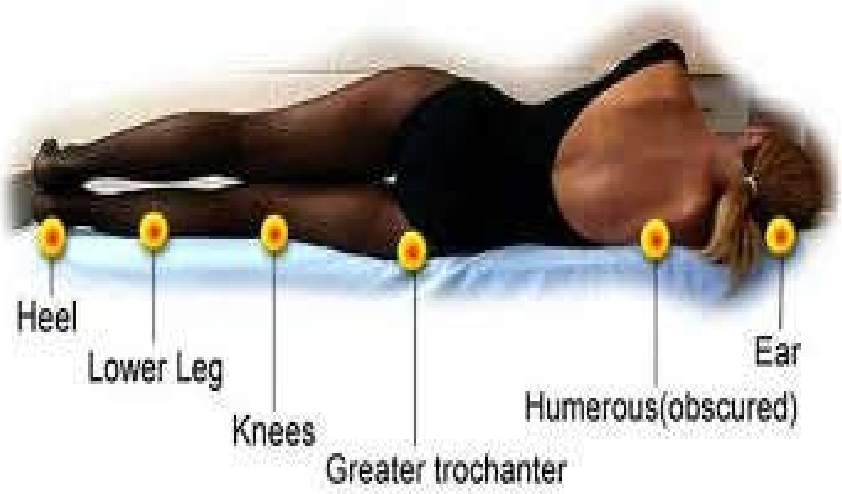


Figure 4: pressure ulcer points on lateral position

Common sites pressure ulcer in supine position:

Heel, thighs, Sacrum. Elbow, humerous vertebrae and occiput Scapula and occiput, sacrum.

Figure 5: pressure ulcer points on supine position

Common sites pressure ulcer on Prone position:

Toes. Patella, thigh, rib cage , ear , nose, forehead and iliac crests.

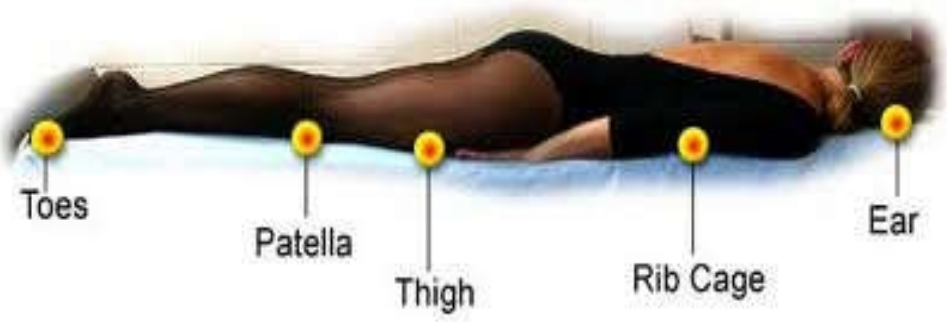


Figure 6: pressure ulcer points on prone position

Common sites pressure ulcer on sitting position:

Shoulders plade, posterior knee, sacrum and coccyx, Buttocks and Sole.

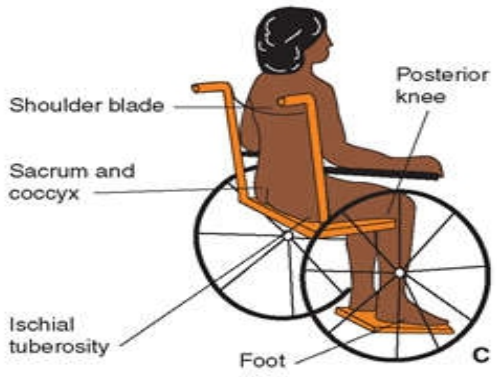


Figure 7: pressure ulcer points on sitting position

2.9. Signs and symptoms of pressure ulcer:

Pressure ulcers caused by pressure lead to inadequate blood supply, this shortage of blood supply, called ischemia, may lead to tissue damage and cell death. The sore will initially start as a red, painful area. The other process of pressure ulcer development is seen when pressure is high enough to damage the cell membrane of muscle cells. The area becomes cold to touch and insensitive, local edema forms the muscle cells die as a result and skin fed through blood vessels coming through the muscle die. Finally the area becomes blue, purple or mottled, gangrene develops and sloughed off.[71]

2.10. Stages of pressure ulcer:

Pressure ulcers are classified into different groups by category (sometimes called grades), based on how severe they are. This helps healthcare professionals to determine the most appropriate form of treatment. The most common system used in the United Kingdom is the European Pressure Ulcer Advisory Panel (EPUAP) system. Category one is the least severe of the categories, with category four being the most severe type.[72] Also the National Pressure Ulcer Advisory Panel in the United States redefined the definition of a pressure ulcer and the stages of pressure ulcers in

2007, including the original 4 stages and adding 2 stages on deep tissue injury and unstageable pressure ulcers. This work was the culmination of over 5 years of work beginning with the identification of deep tissue injury in 2001.[73]

The staging system was defined by Shea in 1975 and provides a name to the amount of anatomical tissue loss. The original definitions were confusing to many clinicians and lead to inaccurate staging of ulcers associated or due to perineal dermatitis and those due to deep tissue injury.[73]

Stage 1: Non-blanchable erythema

It is an intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area. The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Category I may be difficult to detect in individuals with dark skin. May indicate "at risk" persons.[73]

Figure 8: stage 1 pressure ulcer

Stage 2: Partial thickness:-

It is a partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open and ruptured serum-filled or sero-sanginous filled blister. It

presents as a shiny or dry shallow ulcer without slough or bruising. This category should not be used to describe skin tears, tape burns, incontinence associated dermatitis, maceration or excoriation. [73]

Figure 9: stage 2 pressure ulcer

Stage 3: Full thickness skin loss:-

Subcutaneous fat may be visible but bone, tendon and muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. The depth of Category/Stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have (adipose) subcutaneous tissue and Category/Stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep Category/Stage III pressure ulcers. [73]

Figure 10: stage 3 pressure ulcer

Stage 4: extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures with or without full thickness skin loss.

Bone, tendon and muscle are exposed. Slough or eschar may be present. The depth of Category/Stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have (adipose) subcutaneous tissue and these ulcers can be shallow. Category/Stage IV ulcers can extend into muscle and/or supporting structures (e.g., fascia, tendon or joint capsule) making osteomyelitis or osteitis likely to occur. Exposed bone/muscle is visible or directly palpable. [73]

Figure 11: stage 4 pressure ulcer

Additional Categories :

Unstageable/ Unclassified: Full thickness skin or tissue loss – depth unknown.

This is a full thickness tissue loss in which actual depth of the ulcer is completely obscured by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed. Until enough slough and/or eschar are removed to expose the base of the wound, the true depth cannot be determined; but it will be either a Category/Stage III or IV. Stable (dry and intact without erythema or fluctuance) eschar on the heels serves as "the body's natural (biological) cover" and should not be removed. [73]

Figure 12: Full thickness skin or tissue loss – depth unknown

Suspected Deep Tissue Injury – depth unknown:

This is a purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear**.** The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue. Deep tissue injury may be difficult to detect in individuals with dark skin tones. Evolution may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar. Evolution may be rapid exposing additional layers of tissue even with optimal treatment.[73]

Figure 13: evolving deep tissue injury

2.11. diagnosis of pressure ulcer:

Clinical assessment:

Clinical assessment of pressure ulcers begins with identification of patients considered to be at risk and examination for early signs of pressure sore formation at the anatomical sites where such sores are most commonly encountered. A thorough clinical examination is critical to the identification of pressure ulcers that may serve as an occult focus for infection. It is helpful to recognize the typical signs of soft-tissue involvement, such as warmth, erythema, local tenderness, purulent discharge, and presence of foul odor. However, because of associated comorbidities and advanced age, systemic signs, such as fever and leukocytosis, may be minimal or absent, and even local signs of inflammation may not be obvious.[74]

Laboratory tests:

- ✓ Blood test - complete blood count (CBC). To detect present of anemia which lead to decrease blood and oxygen to meet the needs of the body's tissues
- ✓ Blood tests - total serum protein, to see if the patients are getting enough protein in the diet.
- ✓ Tissue cultures to diagnose a bacterial or fungal infection in a wound that doesn't heal with treatment or is already at stage IV
- ✓ Tissue biopsy to check for cancerous tissue in a chronic, non-healing wound

Imaging studies:

Imaging studies are useful in the evaluation of pressure ulcers for determination of the presence of osteomyelitis and for delineation of the extent of deep-tissue involvement.

Plain radiography. Plain radiographs have a limited role in the evaluation of pressure ulcers. Bony changes, such as periosteal reactive

changes and heterotopic new bone formation usually associated with osteomyelitis, can also be present in noninfected pressure ulcers. Furthermore, lytic bony lesions rarely are seen in cases of osteomyelitis associated with pressure ulcers.[75]

computed tomography and bone scintigraphy are neither sensitive nor specific. These imaging techniques may not discriminate osteomyelitis from pressure-related changes in bone .[76] .Currently, magnetic resonance imaging (MRI) is used for evaluating the presence of osteomyelitis in non-healing wounds because of a claimed high sensitivity (84–98%) and specificity (60–89%) .[77]

2.12. Pressure Ulcer Prevention Practice:

According to National Pressure Ulcer Advisory Panel Pressure Ulcer Prevention Points (define) are: risk Assessment, skin care, maintaining nutrition, reduce mechanical Loading, and uses of support surfaces and education.[78]

Risk Assessment:

Pressure ulcer risk assessment tools are aimed to identify patient at risk to pressure ulcer development to target specific risk factor and to define early intervention strategies for prevention. The risk assessment tool is more accurate and more reliable than the clinical judgment to identify patients who are at risk for pressure ulcer development in order to perform initiatory preventive intervention.[79]

Risk assessment tools for pressure ulcers were developed more than 40 years ago and used in measuring the risk status of patients. Most of these risk assessment tools have a numerical score to score risk factors. The total scores indicate the patient's status at 'no risk', 'low risk', 'medium risk', 'high risk', or 'very high risk'. Several risk assessment tools have been developed, such as Norton scale, Braden scale, and Water low to identify individuals at risk for developing pressure ulcer and these tools assist health care professionals to gather information systematically and identify individuals at risk.

Braden Scale: it is a tool that was developed in 1987 by Barbara Braden and Nancy Bergstrom.[80] The purpose of the scale is to help health professionals, especially nurses, assess a patient's risk of developing a pressure ulcer.[81]

The Braden scale assesses a patient's risk of developing a pressure ulcer by examining six criteria.[82]

- ✓ Sensory perception: this parameter measures a patient's ability to detect and respond to discomfort or pain that is related to pressure on parts of

their body. The ability to sense pain itself plays into this category, as does the level of consciousness of a patient and therefore their ability to cognitively react to pressure-related discomfort. [82]

- ✓ Moisture: excessive and continuous skin moisture can pose a risk to compromise the integrity of the skin by causing the skin tissue to become macerated and therefore be at risk for epidermal erosion. So this category assesses the degree of moisture the skin is exposed to. [82]
- ✓ Activity: this category looks at a clients level of physical activity since very little or no activity can encourage atrophy of muscles and breakdown of tissue.[83]
- ✓ Mobility: this category looks at the capability of a client to adjust their body position independently. This assesses the physical competency to move and can involve the client's willingness to move. [82]
- ✓ Nutrition: the assessment of a client's nutritional status looks at their normal patterns of daily nutrition. Eating only portions of meals or having imbalanced nutrition can indicate a high risk in this category. [82]
- ✓ Friction and Shear: friction and shear looks at the amount of assistance a client needs to move and the degree of sliding on beds or chairs that they experience. This category is assessed because the sliding motion can cause shear which means the skin and bone are moving in opposite directions causing breakdown of cell walls and capillaries.[84]

Scoring of Braden scale:

Each category is rated on a scale of 1 to 4, excluding the 'friction and shear' category which is rated on a 1-3 scale. This combines a possible total of 23 points, with a higher score meaning a lower risk of developing a pressure ulcer and vice versa. A score of 23 means there is no risk for developing a pressure ulcer while the lowest possible score of 6 points represents the

severest risk for developing a pressure ulcer.[85] The Braden Scale assessment score scale:

- Very High Risk: Total Score 9 or less
- High Risk: Total Score 10-12
- Moderate Risk: Total Score 13-14
- Mild Risk: Total Score 15-18
- No Risk: Total Score 19-23

Praden scale:

Sensory perception Ability to respond meaningfully to pressure related discomfort	**1.completely limited** Unresponsive 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.slightiy 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 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.	**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] 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. 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.**proplem -** 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.

The Norton Scale:

The Norton and Norton Plus Scales were developed by Doreen Norton, Rhoda McLaren and A.N. Exton-Smith as tools to determine risk of pressure ulcers. The 1962 original and modified versions are widely used today. The Norton scale does not consider nutritional factors, shearing forces and does not have a functional definition of the applied parameters. The Norton Plus Pressure Ulcer Scale has two sections. [86]

1. Section One — Score/Description Section one of the scale assesses five parameters for pressure ulcer (physical condition, mental state, activity level, patient mobility and incontinence) using a scale of one to four. Total scores range from five to 20, understood like this: No to low risk = 16 to 20, Moderate risk = 13 to 15, High risk = 5 to 12

Norton Scale for Assessing Risk of Pressure Ulcers

Name: _____ Date: _____

Criterion	Score
Physical condition	4 = Good
	3 = Fair
	2 = Poor
	1 = Very bad
Mental condition	4 = Alert
	3 = Apathetic
	2 = Confused
	1 = Stupor
Activity	4 = Ambulant
	3 = Walk with help
	2 = Chair bound
	1 = Bed bound
Mobility	4 = Full
	3 = Slightly impaired
	2 = Very limited
	1 = Immobile
Incontinent	4 = Not
	3 = Occasionally
	2 = Usually/Urine
	1 = Doubly

TOTAL SCORE = _____ out of 20

2. Section Two — Deductions

Norton plus scale' is a modified scale in which the presence of the following are noted.[87]

- Diabetes
- Hypertension
- Hematocrit – in males < 41%, in females < 36%
- Hemoglobin – in males <14gm %; in females < 12gm %
- Serum albumin level < 3.3 gm%
- Fever - temperature >99.6°F
- Prescription of ≥ 5 medications
- Changes in mental state within 24 hours to confused, lethargic.

(Total Norton Scale - Total Number of Check Marks = Total Norton Plus Score)

Waterlow Scale.

In 1987, Judy Waterlow devised the Waterlow scale following an extensive literature search and pilot studies within her local areas. She felt that the Norton scale did not address nutritional issues, account for underlying pathology, or highlight the risk of patients undergoing surgical procedures. In comparison to the Norton and Braden scale, the Waterlow scale identifies significantly more risk factors in the assessment tool, this large number of parameters making it complex. It states that women are at a higher risk of developing pressure ulcer than men.[88]

The following areas are assessed for each patient and assigned a point value.

- Build/weight for height
- Skin type/visual risk areas

- Sex and age
- Malnutrition Screening Tool
- Continence
- Mobility

Additional points in special risk categories are assigned to selected patients.

- Tissue malnutrition
- Neurological deficit
- Major surgery or trauma

The tool identifies three 'at risk' categories,

- a score of 10-14 indicates 'at risk'
- a score of 15-19 indicates 'high risk'.
- a score of 20 and above indicates very high risk

waterlow Scale for Assessing Risk of Pressure Ulcers

Name: _____ Date: _____

Risk category and score		**Date**	
		Time	
Build/Weight for Height	Average (BMI = 20 - 24.9)		0
	Above Average (BMI = 25 - 29.9)		1
	Obese (BMI = > 30)		2
	Below Average (BMI = <20)		3
Continence	Complete/Catheterised		0
	Urinary Incontinence		1
	Faecally Incontinence		2
	Urinary & Faecal Incontinence		3
Skin Type/Visual Risk Areas	Healthy		0
	Tissue Paper		1
	Dry		1
	Oedematous		1
	Clammy / Pyrexia		1
	Discoloured - Grade 1		2
	Broken/Spots - Grade 2- 4		3
Mobility	Fully		0
	Restless/Fidgety		1
	Apathetic		2
	Restricted		3
	Bed bound inert/traction		4

	Chair Bound eg Wheelchair	5
Sex	Male	1
	Female	2
Age	14 - 49	1
	50 - 64	2
	65 - 74	3
	75 - 80	4
	81 +	5
Appetite	Average	0
	Poor	1
	NG Tube/Fluids Only	2
	NBM/Anorexic	3
Tissue Malnutrition	Terminal Cachexia	8
	Cardiac failure	5
	Peripheral vascular disease	5
	Anaemia (Hb <8)	2
	Smoking	1
Neurological Deficit	Diabetes, Cerebrovascular accident, renal failure motor/sensory probems, paraplegia	4-6
Major Surgery/ Trauma or Organ failure	Orthopaedic/Spinal	5
	On Table > 2 Hours	5
	On Table > 6 Hours	8
	Single organ failure	8
	Multiple organ failure	8
Cytotoxics	Long Term/High Dose Steroids	4
	Long Term Anti-inflammatory	4

Name of Assessing Nurse	
Signature	
Designation	

Pancorbo-Hidalgo PL. etal (2006) conducted study to determine the effectiveness of the use of risk assessment scales for pressure ulcer prevention in clinical practice, degree of validation of risk assessment scales, and effectiveness of risk assessment scales as indicators of risk of developing a pressure ulcer. A systematic bibliographical review was conducted, based on a search of 14 databases in four languages using the keywords pressure ulcer or pressure sore or decubitus ulcer and risk assessment. Reports of clinical trials or prospective studies of validation were included in the review. The study found that Braden Scale shows optimal validation (66.7%) and the best sensitivity/specificity balance (57.1%/67.5%, respectively); its score is a good pressure ulcer risk predictor. The Norton Scale was the second most efficient predictor (60.2%), it has reasonable scores for sensitivity (46.8%), specificity (61.8%) and The Waterlow Scale offers a high sensitivity score (82.4%), but low specificity (27.4%). Nurses' clinical judgement (only considered in three studies) gives moderate scores for sensitivity (50.6%) and specificity (60.1%), but is not a good pressure ulcer risk predictor (below 33%).[89]

Finally the Braden Scale has the best validity and reliability indicators across many studies and settings. Both Braden and Norton Scales predict pressure ulcer development better than nurses' clinical judgment, while the Waterlow Scale is highly sensitive but not very specific in predicting pressure ulcer development. Use of a pressure ulcer risk assessment scale improves pressure ulcer preventive interventions but is not, by itself efficacious in decreasing pressure ulcer incidence. [89]

Skin Care:

Although expert opinion maintains that there is a relationship between skin care and pressure ulcer development, there is a paucity of research to support that. How the skin is cleansed may make a difference. One study found that the incidence of Stages I and II pressure ulcers could be reduced by educating the staff and using a body wash and skin protection products.[90]

Moreover, healthy adults are usually able to assess and care for their own skin, however, at extremes of age and during periods of illness skin assessment and care may need to be carried out by carers or healthcare professionals. If skin assessment is to be undertaken, the individual should be informed of the reasons and procedures so that they can consent and participate where able. Skin assessment requires moving the individual in order to examine the skin and therefore healthcare providers should use appropriate moving and handling techniques and equipment to prevent harm to themselves or the individual. It is also important that skin assessment is carried out in the right environment where there is good (preferably natural) lighting to observe the colour and texture of the skin and where a person's privacy, dignity and warmth can be respected.[91] skin should be checked at each repositioning or turn. Skin overlying bony prominences of the sacral area, the heels, and the greater trochanters should be paid special attention. Skin assessment should be done at least daily for the sign of impaired skin integrity.[33]

Skin hygiene: In order to maintain skin integrity, irritant substances should be minimized. Skin should be kept clean and dry, without excessive dryness. Urine, feces, perspirations, and wound drainage are susceptible to induce skin injury thus leading to skin break down.[92] Skin should be cleansed at the time of soiling and washed with mild detergent with warm water (Avoid using hot water) followed by applying moisturizer over the skin to minimize

irritation and drying(ointments and creams).[93] Skin rubbing and massage over bony prominences must be avoided.[93,94]

Skin moisture maintenance: Continuous moisture on the skin must be prevented by meticulous hygienic measures. Perspiration, urine, stool, and drainage must be removed from the skin promptly. The soiled skin should be washed immediately with mild soap and water and blotted dry with a soft towel. The skin may be lubricated with a bland lotion to keep it soft and pliable. Drying agents and powders are avoided. Topical barrier ointments (eg, petroleum jelly) may be helpful in protecting the skin of patients who are incontinent. Absorbent pads that wick moisture away from the body should be used to absorb drainage. Patients who are incontinent need to be checked regularly and have their wet incontinence pads and linens changed promptly.[95]

Maintenance of a stable skin temperature: Overheating of the skin has a greater risk of pressure ulcer development and contributes to increased perspiration. Maintenance of a stable skin and body temperature is important in reducing the metabolic and oxygen demands of the body.[96]

Nutrition to Maintain Healthy Skin:-

Meticulous pressure care is the mainstay of prevention and treatment of pressure ulcers. And, while medical nutrition therapy is recognized as playing an important adjunct role in the prevention of pressure ulcers, there has been a lack of quality evidence-based research into this area, with current nutrition recommendations generally based on small studies and expert opinions.[97]The likely mechanism by which nutritional support assists in the prevention of pressure ulcers is unknown; however, it is believed to be associated with an improvement in nutritional intake and therefore nutritional status. An improvement in nutritional status along with associated weight gain would increase soft-tissue ‘padding’ over bony prominences, helping to distribute pressure on underlying tissues over a wider area, reducing the risk of blood flow

occlusion. Furthermore, skin condition would be improved, increasing its resistance to the effects of pressure, shear force and friction. In addition, the extra fluid consumed as a result of nutritional support may reduce the incidence of dehydration – an independent risk factor for pressure ulcer development.[98]

Nutrition in the treatment of pressure ulcers

The optimal nutrient intake to promote the healing of pressure ulcers is unknown, with current recommendations based on limited studies of heterogeneous design. Energy and protein, arginine and micronutrients (vitamins A and C and zinc) are all important in the wound healing process and current recommendations tend to focus on these particular nutrients. While it appears intuitive that these aforementioned nutrients play an important part in the wound healing process, current published research only provides limited guidance as to the optimal combination, dose and duration of these nutrients either alone or in combination.[99,100]

Energy and protein: Increased energy and protein intakes are typically promoted for patients with pressure ulcers, with recent recommendations by the European Pressure Ulcer Advisory Panel (EPUAP) advocating a minimum of 30-35kcal per kg body weight per day and 1-1.5g protein per kg body weight per day.[101] These guidelines for energy and protein intake are in agreement with previously published figures of 30-35kcal/kg and 1.25- 1.5g protein per kg by the Agency for Health Care Policy and Research (AHCPR).[102] While there is a strong case to argue for additional energy and protein to aid in pressure ulcer healing, there is little in the way of definitive trials that support these recommendations, nor to provide for a graded approach to energy and protein supplementation according to the severity of the pressure ulcer, nor to assess the extent of malnutrition if present. A country-by-country review of nutrition recommendations for pressure ulcers showed a large degree of heterogeneity in recommendations for the nutritional management of pressure ulcers, though concluded that adequate energy and protein in the range specified by the European Pressure Ulcer

Advisory Panel (EPUAP) may accelerate the healing of pressure ulcers.[103] Protein is required for all stages of the wound healing process, including fibroblast proliferation, collagen synthesis, angiogenesis and immune function. Current recommendations for protein intake to promote pressure ulcer healing (when combined with adequate energy to prevent protein being used as an energy substrate) are based on achieving positive nitrogen balance, although exact requirements are difficult to assess and are likely dependent on the severity of the wound, metabolic stress from comorbidities, as well as nitrogen losses from draining wounds and fistula.[104]

Arginine: There is considerable interest in the potential therapeutic role of arginine to enhance wound healing and prevent pressure ulcer development. Arginine, a dietary conditionally essential amino acid, has been shown to possess numerous unique and potentially useful pharmacologic effects.[105] Arginine functions as a substrate for protein synthesis, collagen deposition, cell proliferation, T-lymphocyte function and promotes positive nitrogen balance.[106] It is also the biological precursor for nitric oxide, which has potent vasodilatory, anti-bacterial and angiogenic properties – all important processes in wound healing.[106] Based on normal protein intakes, habitual arginine intake of an average diet is 5-6g/day, although one study in elderly nursing home residents with pre-existing pressure ulcers reported a much lower dietary arginine intake of between 2.4-3.3g/day.[107]While arginine is not essential for normal growth and development, it is considered essential in times of metabolic stress and poor oral intake. As pressure ulcers can be described as chronic inflammatory conditions, and frequently exist in malnourished individuals with poor oral intake, it is thought that supplemental arginine may play an important role in pressure ulcer healing. [106]

Ascorbic Acid: Ascorbic acid (vitamin C), a water soluble vitamin, is a cofactor with iron during the hydroxylation of proline and lysine in the

production of collagen. Thus ascorbic acid is important for tissue repair and regeneration.[108] Deficiency can be associated with impaired fibroblastic function and decreased collagen synthesis, which can result in delayed healing and capillary fragility. Ascorbic acid deficiency is also associated with impaired immune function which can decrease the ability to fight infection.[108]

Zinc and Copper: Zinc is a mineral that functions as an antioxidant and is associated with collagen formation, synthesis of protein, DNA and RNA, and cell proliferation. Inflammatory cells, epithelial cells and fibroblasts are proliferating cells.[109] Zinc is transported through the body primarily by albumin, therefore, zinc absorption declines when plasma albumin declines, such as in protein energy malnutrition (PEM), trauma, sepsis or infection.[110] Deficiency of zinc may be the result of wounds with increased drainage, poor dietary intake over a long period of time, or excessive gastrointestinal losses. Zinc deficiency may cause loss of appetite, abnormal taste, impaired immune function and impaired wound healing. Good sources of zinc include high protein foods such as meat, liver, and shellfish. In fact, caution has been advised against the use of high-dose zinc supplements (>40mg/day) as they have been linked to impaired copper status (which can impact on collagen crosslinking), gastrointestinal disturbances, reduced immunity and altered lipid profiles.[111]

Vitamin A: performs a number of functions in wound healing. Vitamin A acts on the immune system and may be important during the inflammatory phase of wound healing because it increases the number of macrophages and monocytes in the wound bed. Vitamin A also enhances epithelization, increasing collagen formation, and it inhibits the negative effects of glucosteroids, chemotherapy, radiation, diabetes, and excessive vitamin E supplementation on wound healing.[112] Vitamin A deficiency results in impaired wound healing and alterations in immune function that may increase the likelihood of wound

infections. Recommendation for vitamin A is 900 retinol activity equivalents (RAE) for men and 700 for women per day. Documented recommendations for the amount of vitamin A for enhanced wound healing in injured patients have ranged from 10,000 to 50,000 IU per day orally and 10,000 IU intravenously for moderately to severely injured patients (or for malnourished individuals) for a time limit of no more than 10 days, secondary to the effects of possible toxicity. For individuals receiving steroids, vitamin A doses of 10,000 to 15,000 IU/day for 1 week are recommended prophylactically to counteract the anti-inflammatory effects of steroid therapy and immune suppression.[112,113]

Mechanical Loading and Support Surfaces:-

Pressure-relieving strategies are the cardinal approach for the prevention and treatment of pressure ulcers.[114] It involves:

- Careful patient positioning.
- Elimination of heel pressure.
- Use of support surfaces.
- Elimination of shear and friction.
- Promotion of mobility and activity.
- Educational Program for Patient, Family.

Positioning and repositioning: all patients should be encouraged to reposition themselves regularly when able to do so. For those who require assistance, repositioning should be undertaken with consideration for the patient's comfort, dignity and functional ability. To the extent the patient is able, one should encourage activity. Even a few steps done frequently will help to maintain current activity level, mobility, and range of motion. Lifting devices, such as an overhead trapeze or bed linen, are helpful when moving patients. It is important to minimize dragging during transfers and position changes.[115] Posting an individualized turning schedule in patient rooms can be helpful to

healthcare professionals and patients. If the individual is to remain in bed, his or her position should be changed regularly and at least every two hours (although this should be adjusted to suit individual requirements as some patients may need more frequent intervention than others). Patients should be rested at a 30-degree tilt and on alternate sides to avoid prolonged pressure at bony prominences.[116]

Chair bound patients require special attention to positioning as well. The risk of pressure ulcers from prolonged sitting is greater than that from reclining in bed, as sitting puts the patient's weight on the relatively small surface areas of the buttocks, thighs, and soles of the feet. Much of this weight is centered over the small area of tissue covering the ischial tuberosities. It is important for patients who sit in a chair to regularly change position. A dependent patient must have his/her position changed in a chair at least every hour. Patients who are able to move themselves should shift their weight (even slightly) every 15 minutes.[117]

A patient should be properly positioned in a chair for postural alignment, distribution of weight, balance, and stability. Patients should sit with their back erect and against the back of the chair, thighs parallel to the floor, knees comfortably parted, and arms horizontal and supported by the arms of the chair. This position distributes weight evenly over the available body surface area. Slouching can cause shearing and friction and places undue pressure on the sacrum and coccyx. Feet should be kept flat on the floor to protect the heels from pressure and distribute the weight of the legs over the largest available surface area. The thighs and arms should remain parallel to ensure that weight is evenly distributed instead of being focused on the ischial tuberosities and elbows. Parting the knees will prevent the knees and ankles from rubbing together. If a patient uses a footstool, it is vital that his or her knees are not above hip level, because this shifts the weight from the back of the thighs to the

ischial tuberosities. This same problem can occur if the chair is too short for the patient.[117]

Elimination of heel pressure: the heels are particularly vulnerable, and pressure ulcers at this location are very painful, and difficult to heal, and prone to infection with easy access to adjacent bone. Heel pressure ulcers can develop infection, and advanced cases may lead to amputation of the foot. To protect the heels, place a pillow under the calf to float the heels out of the bed. There are also devices available that eliminate pressure on heels and prevent foot drop (e.g., suspension boots). Current guidelines state that heels are to be kept off the bed.[118]

Support surfaces: are indicated when patients are not able to reposition themselves or when periodic repositioning care is not available. An ideal support surface will manage microclimate, tissue loads, and other curative functions. Seat cushions, overlays, mattresses, and integrated bed systems are commonly used to prevent pressure ulcers. The type of device or surface selected is based on level of risk as well as degree of assistance necessary for repositioning or mobility.[119]

Elimination of shear and friction: Immobile and inactive individuals were exposed to the forces of shear and friction due to lifting, turning, and positioning over bony prominences. Friction was experienced during repositioning and was dragged over the rough surface of the bed linen. To avoid friction, proper lifting and manual handling techniques should be employed. Turning devices, slide sheets and slide boards may be used during lifting and transferring.[120] Skin should be protected with padding or protected dressing of hydrocolloids or transparent films. The force of shear can be reduced by elevating the foot of the bed by 10 to 20 degree. This helps to prevent sliding when sitting or semi-recumbent. The head of the bed should also be maintained

at the lowest possible elevation no greater than 30 degree according to individuals' medical condition and comfort.[121]

Promotion of mobility and activity: Movement is the body's defense against pressure ulcers and other complications from being bedridden. People with reduced sensitivity, paralysis, contractions or unconsciousness do not respond to the body's warning signals, due to reduced or failed reaction or inability to feel pain or discomfort. Therefore, help is needed regularly to change position. Small, frequent changes in position are often sufficient for the circulation to work.[122] Mobilization and activity alter pressure on weight bearing areas, relieving stressed or damaged tissue and improving circulation. Individuals should be encouraged to maximize activity and mobilization in accordance with their medical condition, ability, and energy level. Health care team can use devices, such as trapeze, cot sides, cane, walker or handrails to assist individual with activity and mobilization.[33] Immobile patient has a negative effect from restricted movement, their joint that has not been moved sufficiently can begin to stiffen within 24 hours and will eventually become inflexible. With longer periods of joint immobility, the tendons and muscles can be affected as well. Most people move and exercise their joints through the normal activities of daily living. When any joint cannot be moved in this way, the patient or nurse must move it at regular intervals to maintain muscle tone and joint mobility. Range of motion (ROM) exercises are ones in which a nurse or patient move each joint through as full a range as is possible without causing pain. The effect of both regular exercise and immobility on major body systems are discussed in this lesson.[120] The nurse also should Perform massages to the patient by consisting of small rubbing frictions that should be performed repeatedly and frequently, but not during long-lasting periods (only 10 to 15 seconds per area at risk). Massages are mainly meant to provide a feeling of wellness and support close relational contacts, which can always be useful.

Massages are performed by full hand contact in a back-and-forth gesture. Some products can ease the sliding movement of the hands, but they should not have a drying or moisturizing effect (maceration) on the non-affected skin. It is therefore recommended to alternate regularly between emulsions.[123]

Educational Program for Patient and Family: A vital component of any pressure ulcer program is patient/family education, with an overall goal of decreasing the incidence of ulcer development or recurrence. If possible, pressure ulcer prevention should not be a passive process for the patient and his/her family members. Rather, it should be a dialogue in which the patient and family feel comfortable asking questions and discussing problems. Patients should have as much control as possible in the plan of care. Empowerment is very important in maintaining the patient's physical and emotional well-being, and the plan of care should be explained thoroughly cognitively aware patients and/or their family. It is important for everyone involved to appreciate that the prevention of ulcer formation is a lifelong process.[124]

At the same time, it is necessary to evaluate the patient's/family's existing knowledge regarding pressure and pressure ulcers. Healthcare professionals should show patients what they can do to facilitate pressure relief (e.g., how to make small position changes while in the chair). If possible, teach patients how to do simple range-of-motion exercises. Take time to train the patient as often as is appropriate; not everyone will absorb the information the first time they hear it.[125] It is important not to let noncompliance or a bad attitude from the patient or family discourage the teaching process. The subject should be approached as often as is reasonable. Include the family members and caregivers in the instructions; as well as assisting with care, they can encourage compliance. All efforts at patient and family/caregiver education should be documented, along with the patient's response (both verbal and behavioral). Different methods of teaching, such as photographs, videos, charts, diagrams, and written materials in

the patient's native language, should be used. Education should be reinforced regularly and consistently. The information provided to patients and/or their families should be specific to the individual treatment plan and goals. [126]

2.13. Management of pressure ulcer:

When a pressure ulcer develops, nursing's patient safety goal is to assist the health care team in closing the ulcer as quickly as possible. Nursing is also concerned with preventing further ulcer deterioration, keeping the ulcer clean and in moisture balance, preventing infections from developing, and keeping the patient free from pain.

The management of pressure ulcers is interdisciplinary,including primary care physicians, dermatologists, infectious disease consultants, social workers, psychologists, dietitians, and wound-care nurses, rehabilitation professionals, and surgeons. The basic components of pressure ulcer management are reducing or relieving pressure on the skin, debriding necrotic tissue, cleansing the wound, managing bacterial load and colonization, and selecting the type of wound dressing.[127]

The first step in treating a sore at any stage is relieving the pressure that caused it. There are many strategies to reduce pressure include, repositioning and specialized support surfaces are available for bedding and wheelchairs, which can maintain tissues at pressures below 30 mm Hg.[128,123]

The second step is cleaning. A stage I wound can be gently washed with water and mild soap, Regular wound cleansing is necessary to remove contaminants, bacteria, and remnants of previous dressings from the wound surface and adjacent area, usually with the help of fluids (irrigation). This process helps accelerate the healing process and decreases the likelihood of infection. The ulcer and surrounding skin should be cleansed at least daily. If the dressing is being changed more than once daily, wound cleansing should be done during each dressing change.[129]

Generally, normal saline is used for cleansing pressure ulcers. In ulcers with necrotic tissue, debris, or confirmed or suspected infection, antimicrobials or surfactants should be considered. For infected wounds, diluted povidone-iodine may be used as the irrigation fluid. However, it should not be used during the granulation phase of healing. Acetic acid (0.5%) is highly effective in fungating lesions, especially against pseudomonas aeruginosa. There are various cleansing agents available in the market, but normal saline is usually the best option.[130]

The third step debridement is removing of dead tissue, which promotes bacterial growth and impairs wound healing;Debridement has been shown to accelerate the healing process in some patients with advanced ulcers. In addition to helping move the wound through the stages of healing, debridement is often necessary to visualize the wound bed and to stage the wound; a wound covered with necrotic tissue cannot be staged.[131]An exception is eschar on the heels, which acts as a natural biological cover and should not be removed unless infection is present.

The method of debridement used depends on the amount of necrotic tissue present, the location of the wound, and the patient's overall condition.[132] Patients with stage III or IV pressure ulcers who have undermining and/or tunneling or extensive necrotic tissue should have a surgical evaluation for possible surgical debridement of the wound, if this is consistent with their condition and goals of care.[133] Infected wounds may require systemic antibiotic treatment and immediate surgical debridement.[131] Maintenance debridement should be continued until there is a covering of granulation tissue in the wound bed and the wound is free of necrotic tissue. Debridement is contraindicated if there is inadequate blood supply to support wound healing. [133]

Removing these tissues (debridement) is accomplished with five ways, depending on the severity of the wound, general condition and the treatment goals.

Autolytic debridement using hydrocolloids and hydrogels. Rehydration of necrotic tissue through the use of a hydrogel or by keeping the wound moist, and removal of devitalised tissue using the body's own enzymes. This method is in common use but prolongs the time needed for debridement**.** [134] A layer of wound exudate should be kept in contact with the surface of the wound, usually using a moisture-retaining dressing.[131] This allows fluid to accumulate in the wound, rehydrating necrotic tissue and making it possible for enzymes in the wound to digest the dead tissue. For a wound covered with dry eschar, it is appropriate to crosshatch the eschar, as this allows a faster build-up of moisture in the wound.[132] In their clinical practice guidelines for pressure ulcer treatment, the Agency for Healthcare Research and Quality recommends autolytic and enzymatic debridement as the preferred approach for patients in long-term care and home care and for patients who cannot tolerate other methods of debridement.[132,135] In general, this type of debridement is ideal for patients with stage III or IV ulcers with light-to-moderate exudates.

Autolytic debridement is highly selective; healthy tissue is spared and only necrotic tissue is liquefied. It is considered very safe, as it uses patient's own immune system to promote healing and clean the wound of necrotic tissue. Autolytic debridement is easy to perform, very effective, and can be combined with other approaches. It is almost painless for the patient, making it a very attractive option. However, there are disadvantages as well. It is comparatively slow in efficacy compared to surgical debridement, with progress usually seen in about one week.[132] Close monitoring of the ulcer is necessary to detect signs of infection. There is a risk of anaerobic growth when an occlusive hydrocolloid dressing is used, and this approach should not be used in infected ulcers.

Biological debridement or maggot debridement therapy: is the use of medical maggots to feed on necrotic tissue and therefore clean the wound of excess bacteria. This type of debridement is especially effective when sharp debridement is contraindicated due to the exposure of bone, joint, or tendon.[136] However, some patients complain of a crawling or tingling feeling . Maggot therapy may also cause psychological distress for many patients, and its use should be discussed thoroughly with the patient and/or family prior to commencing therapy. This therapy should only be used with appropriately informed consent.[115]

Chemical debridement or enzymatic debridement: Enzymatic debridement is used either alone or in combination with other techniques to remove necrotic tissue and promote wound healing. It is also indicated when surgical debridement is not possible. Concentrated enzymes (such as collagenase papain) are applied to help loosen the necrotic tissue, which is then manually removed. Usually, stage III or IV ulcers are considered candidates for enzymatic debridement. Application of the enzyme should be discontinued when the wound is free of necrotic tissue. If eschar is present, it should be crosshatched prior to introduction of the enzyme to improve efficacy, as enzymes are not active on a dry surface.[136,137] Enzymatic debridement is relatively fast acting, with progress evident in 48 to 72 hours. However, complete debridement may be a long process, so other methods (e.g., surgical removal of loosely adherent necrotic tissue) are often used in conjunction.

Enzymes should be applied only to necrotic tissue; if applied correctly, healthy tissues should be spared. It can be expensive and time consuming, with a high number of dressing changes necessary. Inflammation, pain, and discomfort may occur. [136,137]

Mechanical debridement uses a nonselective, physical method of removing necrotic tissue and debris from a wound using mechanical force. One common form of mechanical treatment is wet-to-dry gauze to adhere to the necrotic tissue, which is then removed. Upon removal of the gauze dressing, necrotic tissue and wound debris are also removed. The challenge with mechanical debridement is the possibility that healthy granulation tissue may be removed as well, along with the devitalized tissue, thereby delaying wound healing and causing pain.(137)

Sharp debridement: (use of scalpel or laser) is probably the most effective type of debridement because of the time involved to remove the devitalized tissue.(138)

The forth step is managing bacterial burden: bacteria is one of the most common reasons for delayed healing in pressure ulcers. Bacteria occur rapidly in wounds and stalls healing by keeping the wound inflamed. Frequent debridement and antimicrobial dressings are needed to control the bacteria. Symptoms of infection in a pressure ulcer include slow or stalling healing, pale granulation tissue, pain, redness, swelling, warmth of the area, and purulent discharge. Additionally, infected wounds may have a gangrenous smell, be discolored, and may eventually exude even more pus. In order to eliminate this problem, it is imperative to apply antiseptics at once. Dressings with silver or honey have been shown to penetrate bacteria. Systemic antibiotics are not recommended in treating local infection in a pressure ulcer, as it can lead to bacterial resistance. They are only recommended if there is evidence of advancing cellulitis, osteomyelitis, or bacteremia.(139)

2.14. Complications of pressure ulcers:

Without proper care and treatment, a superficial stage I or II ulcer can evolve to a more serious and severe stage III or IV ulcer. The complications of more severe ulcers, including sepsis, cellulites, and malignancies, can become life-threatening even with the best possible treatment and care.

Cellulites: Cellulites can occur when infection spreads from the site of the ulcer to a deeper layer of skin, causing acute infection of connective tissue and possibly leading to sepsis. In rare cases of pressure ulcers involving the spine, coccyx, or lower back, cellulites can progress to meningitis. Staphylococci and streptococci are the most common causative agents of cellulites.[140] Physical exam may reveal signs of infection, including erythema, edema, warmth, and possibly increased drainage. Lymphadenopathy may be present near the area of cellulitis. Diagnosis may be confirmed by blood culture, complete blood count (CBC), or fluid or exudate culture from the affected area. Treatment usually involves a course of antibiotics. Analgesics may be necessary if the area is painful. [141]

Sepsis and septic shock: Sepsis is of the most serious complications of pressure ulcers. When bacteria present in the wound enter the bloodstream, systemic inflammatory response syndrome (SIRS), septic shock, and multi-organ failure can result. This cascade of events can ultimately lead to death.[140.141]

Bone and joint infection: Infection can also spread from a pressure ulcer into underlying joints (septic arthritis) and bones (osteomyelitis). Both of these infections can damage the cartilage, tissue and bone. They may also affect the joints and limbs. Antibiotics are required to treat bone and joint infections. The goals in the treatment of bone or joint infections are to eradicate infection and reduce damage to the bone and adjacent tissues. Antibiotics are prescribed, often

intravenously. In order to select a proper antibiotic, laboratory confirmation of the pathogen and its sensitivities is required. Surgical removal of bone necrosis may be indicated.[142]

Necrotizing fasciitis: Patients with stage III and IV ulcers are at a risk for contracting the rapidly progressive infection necrotizing fasciitis. Necrotizing fasciitis is defined as a group A streptococcal infection of the fascia with accompanying necrosis of the subcutaneous tissues. It is an uncommon consequence of pressure ulceration.[142,143]

Initial signs of this condition are fever, pain, and massive swelling. Visual and microscopic evaluation of the tissues confirms the diagnosis. Emergency treatment is required, and aggressive surgical debridement is vital to prevent spreading. As soon as necrotizing fasciitis is suspected, antibiotics should be started. A combination of intravenous antibiotics, usually clindamycin, vancomycin, and penicillin, is administered. Hyperbaric oxygen therapy can also be effective. [142,143]

Gas gangrene: Gas gangrene is a serious but rare form of infection that occurs when a pressure ulcer becomes infected with the clostridium bacteria. The bacteria thrive in environments where there is little or no oxygen. They produce gases and release dangerous toxins. Symptoms of gas gangrene include severe pain and rapid swelling of the skin. Surgical debridement is usually necessary. In very serious cases, excision with amputation is required to prevent spread of the infection. Penicillin is administered as adjuvant therapy. Hyperbaric oxygen therapy is effective in growth inhibition and killing clostridium perfringens.[144,145]

Recurrences: Recurrence of a pressure ulcer is a common complication of treatment. As noted, as many as 90% of patients with a healed wound will experience a recurrence.[146] Compared to normal tissue, scar tissue has lower tensile strength, poor blood supply, and poor ability to withstand trauma, making it vulnerable to recurrent episodes. If an ulcer recurs at the same site within 4 months of the initial injury, it is likely due to incomplete healing rather than a true recurrence.[147]

Cancer: Long-standing pressure ulcers can develop into malignant tumors called Marjolin's ulcers. These tumors were named for surgeon Jean-Nicolas Marjolin, who first described the condition in 1820. They are very aggressive ulcerating squamous cell carcinoma found in the area of ulcers and other long-standing indolent wounds. It can develop many years after the initial trauma.[148]

Endocarditis : which is an infection of the heart lining. Symptoms of endocarditis include vague, flu-like symptoms, such as chronic low-grade fever and fatigue.[149]

Meningitis:which is an infection of the meninges that surrounds the brain and spine. Meningitis causes a severe headache with a stiff neck, fever, nausea, and vomiting. [149]

Abscesses: An abscess can form on the skin or on tissues within the body and cause pain, swelling, and tenderness. [149]

2.15. Factors Contributing to Nurses' Knowledge, and Practice Regarding Pressure Ulcer Prevention:

Several factors are related to nurses' knowledge and practice regarding the prevention of pressure ulcers. They are :(education and training background, years of experience, expertise in the area of preventive practice, lack of nursing leadership, inadequate facilities and equipment, shortage of nurses, work over-loads, and individual beliefs.[150]

Education and training background: Education is one of the important contributing factors for preventing pressure ulcer development. A quasi-experimental study involving 595 registered nurses and 59 licensed practicum nurses was conducted to examine the knowledge before and after two weeks of educational workshop about pressure ulcers. The pre and post test results showed that registered nurses' scores were significantly higher than those of the licensed practicum nurses. thus the nurses who are specifically trained have better knowledge of pressure ulcer prevention.[114] Pieper and Mott stated that the nurses who had recently attended a lecture or read a pressure ulcer related article had higher knowledge than nurses who did not. The researchers reported that nurses' level of knowledge regarding pressure ulcers was higher than that their level of clinical practice. This was due to the lack of awareness and interest of nurses, insufficient time, inadequate leadership, lack of equipment, and an excessive number of patients. High level of knowledge was not always reflected in practice because of other influencing factors.[151]

Years of experience: Nurses' experience of service also is another contributing factor for the prevention of the development of pressure ulcers.. A study was conducted by Zulkowski et al. among 460 nurses in rural and urban areas to assess their knowledge of pressure ulcers. It showed that wound care

nurses obtained high scores (89%) in this area compared with non-wound care nurses (75%).[152]

Lack of nursing leadership: The inadequate leadership given to nurses can decrease the level of nursing practice in pressure ulcer prevention. A two-year study was designed to evaluate the outcomes of implementing clinical practice guidelines to prevent and treat pressure ulcers in primary, secondary and tertiary health centers in Canada. The resulting data showed that lack of leadership for nurses was identified as a barrier for implementing evidence-based guidelines for preventing pressure ulcer development.[153]

Inadequate facilities and equipment: Facilities for dealing with pressure ulcers, such as related learning materials and relevant equipment, are essential elements for nurses to prevent pressure ulcers. Lack of facilities to access literature, lack of opportunities to utilize research findings, and lack of equipment are contributing factors for nurses to implement quality care for pressure ulcer prevention. Previous studies have found a number of barriers for nurses to develop good practice in this field. These include: lack of access to literature; lack of resources and equipments; lack of hospital policies for utilizing risk assessment tools; an absence of evidence-base guidelines; and inadequate utilization of research findings in clinical areas.[154]

Shortage of nurses and work over-loads: The low number of nursing staff is one of the factors for providing inappropriate nursing care to prevent pressure ulcer formation. Previous studies show that lack of time and shortages of nursing staff prevented nurses implementing their positive attitudes into good practice.[155]

Individual beliefs: A positive attitude is an important factor for an individual to transform behaviour into practice. Previous studies have shown

that nurses had negative attitudes regarding pressure ulcer prevention because they believed that pressure ulcer prevention activities have low priority in nursing care. Moore and Price stated that nurses demonstrated a positive attitude towards the awareness of pressure ulcer prevention care. Another study indicated that nurses demonstrated negative attitudes by their preferring their own clinical judgment rather than using a risk assessment scale to assess patients at risk from pressure ulcers.[156]

3. Material and Methods

Subjects and methods of this study presented by four main designs as follows:

1. Technical design.
2. Operational design.
3. Administrative design.
4. Statistical design.

1. Technical Design:

Technical design of the study included research design, setting, subjects, and tools of data collection.

Research design:

A quasi-experimental design used in the conduction of this study to explore the impact of structured teaching program for nurses on knowledge and practice regarding pressure ulcer prevention for hospitalized patient at Almeck Nimir university Hospital. The researcher used one group pretest - posttest design to achieve the purpose of study.

Setting:

This study was carried out at Almek Nimir University hospital. This hospital was established since 2002 and it is considered the second university hospital in Sudan. The hospital provides services for large civilized and rural areas including Shendi town and its locality. This hospital is one of the refereed centers in the country. It provides most types of medical services (outpatient and referred clinics, medicine, surgery, Obstetric and Gynecology, pediatric' ENT, ophthalmology, orthopedic and traumatology and multi-sectional surgical theatre,…). Beside these there are nursery, surgical intensive care unit, medical intensive care unit, coronary care unit (cardiac unit with CCU and cath lap), renal unit including dialysis centre, and oncology centers (providing diagnostic and therapeutic services), central lab

and three labs for routine test and radiology department consisting of X ray, Computed Tomography, ultra sound and echocardiography. The hospital is the educational site for Shendi university's medical and other health college's students. It is likely that patients who are at high risk for pressure ulcer development have to be referred to and admitted at most of the departments of the hospital where specialized services are provided. In the hospital work 130 nurses of different levels of education and certificates. Some of them have been trained in specialized centers such as (dialysis, chemotherapy, cardiac catheterization, surgical operations nursing, and nursery) in Khartoum.

Subjects:

The population of this study included all the nurses who care for patients at Almek Nimir University Hospital, during the period of study and fulfilling the following inclusion criteria and agreed to participate in the study:

Inclusion criteria:

- ✓ Age group – 22 years and above.
- ✓ Both sexes.
- ✓ Nurses who have bachelor, master or doctoral degree.
- ✓ Nurses with different periods of experience (zero and more).

Exclusion criteria:

- ✓ Nurses who work as part timer.
- ✓ Nurses with diploma level of qualification.
- ✓ Nurses who are off work during the time of study.
- ✓ Nurses who refuse to participate.
- ✓ Nurses who participated in the pilot study.

Sampling technique and Sample Size:

All the nurses who care for patients at Almeck Nimir University Hospital at the time of the study and fulfilling the above mentioned criteria

were included in the study population. The total number of all nurses participating in the study is (96) nurses.

Each nurse observed twice before and after implementing the educational program by structured interview sheet and observational checklist used to collect data to achieve the purpose of study.

Tools of Data Collection:

The questionnaire has been developed by the researcher and it was divided into 3 sections including demographic data, nurses' knowledge regarding pressure ulcer and its prevention, and nurses' practice regarding pressure ulcer prevention. The details of each section will be explained as follows:

Section 1: Demographic data:

This questionnaire consisted of 8 items to assess the subjects' demographic data including age, gender, marital status, academic qualification, years of experience, attendance of formal training on pressure ulcer, place of training attendance and current areas of practice.

Section 2: nurses' knowledge regarding pressure ulcer and its prevention:

A questionnaire was prepared to assess the level of nurses' knowledge regarding pressure ulcer and its prevention. It was composed of 34 items multiple choice questions which had been modified and developed from the Pressure Ulcer Prevention Guideline (PUPG). The items were developed to cover different areas such as:

- ✓ Meaning of pressure sores: 1 item.
- ✓ Other nomenclature of pressure ulcer: 1item.
- ✓ Causes and risk factors of pressure sore: 5 items.
- ✓ Sites: 3 items.
- ✓ Signs and symptoms of pressure sore: 3 item
- ✓ Assessment of Pressure sores: 4 items

- ✓ Nutrients and vitamins needed to prevent bed sore : 2 items
- ✓ Nursing management of pressure sores: 14 items
- ✓ Complications of pressure sores: 1 item

Section 3: nurses' practice regarding pressure ulcer prevention:

An observational checklist was developed by the researcher guided by Pressure Ulcer Prevention Guideline, consisting of 16–items.

2. Operational Design:

Operational design included a pilot study, ethical consideration and a field work.

Pilot Study:

A pilot study was carried before actual study (data collection) to test applicability of the tools of data collection and to estimate the time required for filling the required forms. It was carried out with participation of ten nurses to evaluate the content of tools in order to determine whether or not the items were valid and understood by the nurses.

The results of pilot were as follows:

- ✓ The nurses understood the method used to fulfill each tool. They commented that some items need to be modified and rephrased.
- ✓ Based on this pilot results modifications were made , and at the end the researcher was satisfied that each tool is most likely going to achieved the aim of the study .
- ✓ The samples of pilot study were not included in the research result.

Ethical consideration:

To carry out the study, the necessary official approval was obtained from director of hospital. Written informed consents were secured from each subject to participate after explaining the nature, purpose, and benefits of the study. The researcher emphasized that participation in the study is entirely voluntary, and confidentiality and privacy were assured through coding the data.

Experimental design model:

Content	Pre test	Training session	Post test
Knowledge map	O1	X1	O2
Practice map	O1	X1	O2

Note:

1. X1 = the experimental treatments (teaching session).
2. O1 = the pre-test.
3. O2 = the post-test.

Operational procedure

Test	Time	Period	Task
Pre test(O1)	3 month	4 weeks	Questionnaire about pressure ulcer and its prevention: - filled by the nurse (30) Minutes.
		8weeks	Observational skills: - each nurse was observed alone during her duty.
Training (application of the program) for nurses the study group (96 nurses) distributed into eight (8) groups, each group includes (12) nurses. (X1)	4month	1month	Human skin and its function.
		1mounth	Pressure ulcer general (meaning, definitions, causes risk factors, pathophysiology, common sites, sign and symptoms, and complication).
		2 month	Management and prevention of pressure ulcer which include: practice of positioning the pillows when the client in different positions, applying back massage and exercises.
After six month of finishing program.(O2)	3 month	4 weeks	Same pretest questionnaire refilled by the participants (30) minutes.
		8 weeks	Observational skills:-each nurse was observed alone during her duty.

The researcher assured them that all the information obtained is going to be confidential and will be used only for purpose of the study.

Also participant's autonomy and confidentiality was strictly explained for the nurses. The researcher communicated with the nursing superintendent to select the eligible participants to participate and informed the subjects about the objectives and the procedure of this study. Among them 96 participants signed the agreement at the beginning of the questionnaire. Participation was voluntary. All necessary information collected from the participants will remain confidential and it's not allowed for any person to identify it.

4. Statistical Design:

The data was collected and analyzed by using a computerized statistical package for social sciences (SPSS version 19). Results were presented as figures and tables, describes frequency and percentage, paired t-test, Pearson correlation analysis to test statistical significance of some variables and to test effectiveness of the programs. Statistical significance was considered at p-value < .05.

knowledge and practice of nurses regarding the prevention of pressure ulcer. The collected data was tabulated, organized, analyzed and interpreted by using descriptive and inferential statistics.

The results of current study are presented into the following sequences:

1. Characteristics of the study population. figure 1 ----- figure 7
2. Knowledge of the study population regarding pressure ulcer and its prevention. Table 1---- table 14
3. Study population's performance. Table 15----- table 19

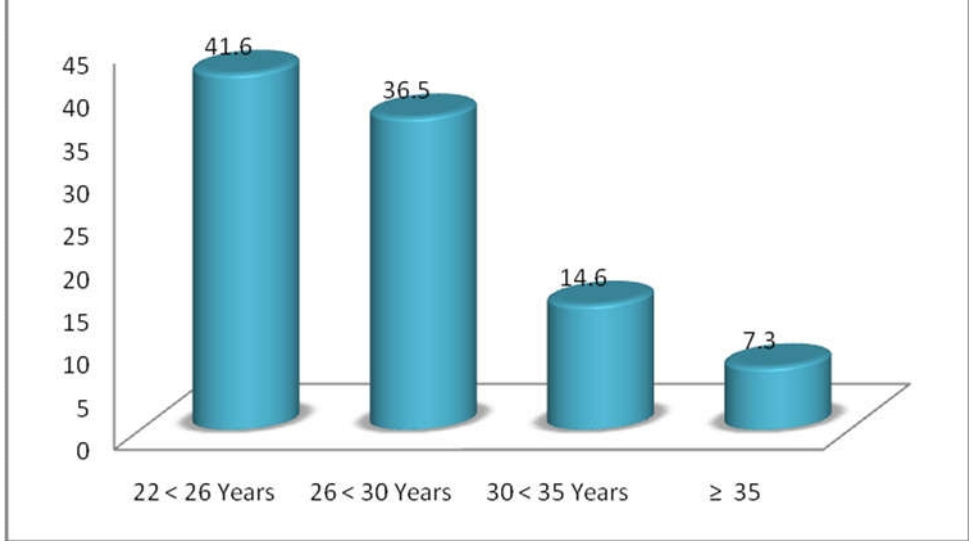


Figure (1) shows the distribution of the study group according to their ages.

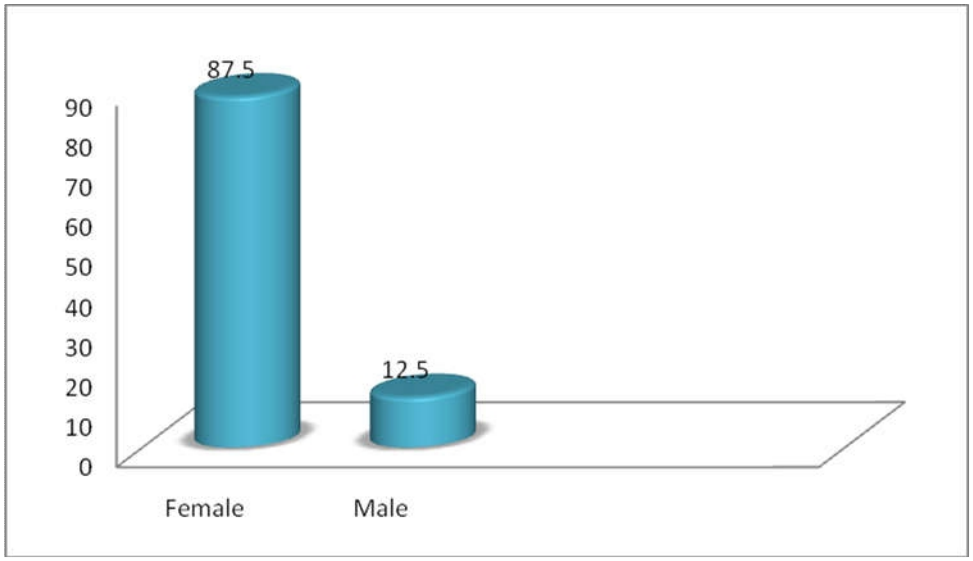


Figure (2) shows the distribution of the study group according to gender.

Figure (3) shows the distribution of the study group according to their marital status.

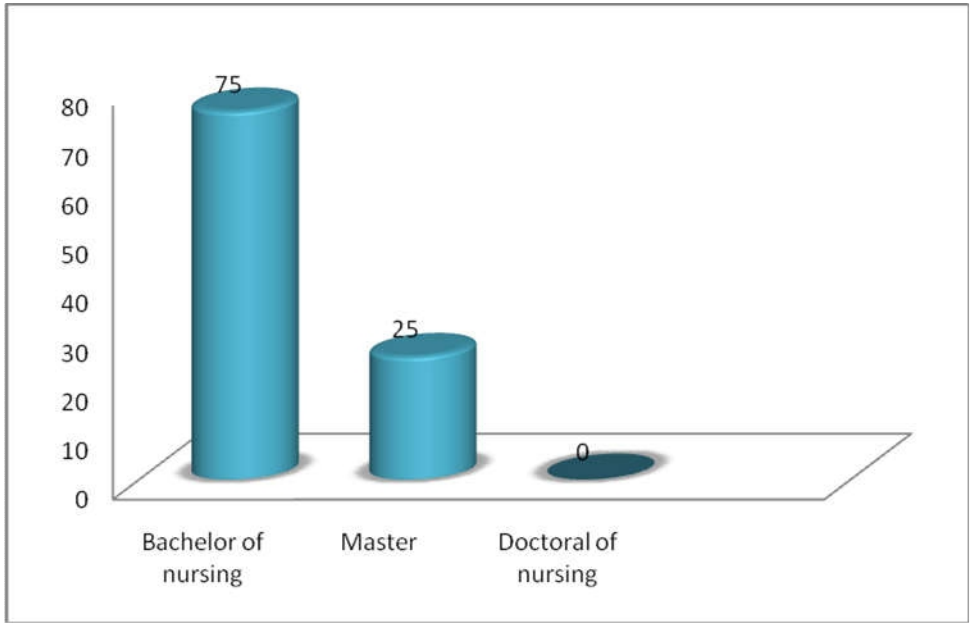


Figure (4) shows the distribution of the study group according to their academic qualification.

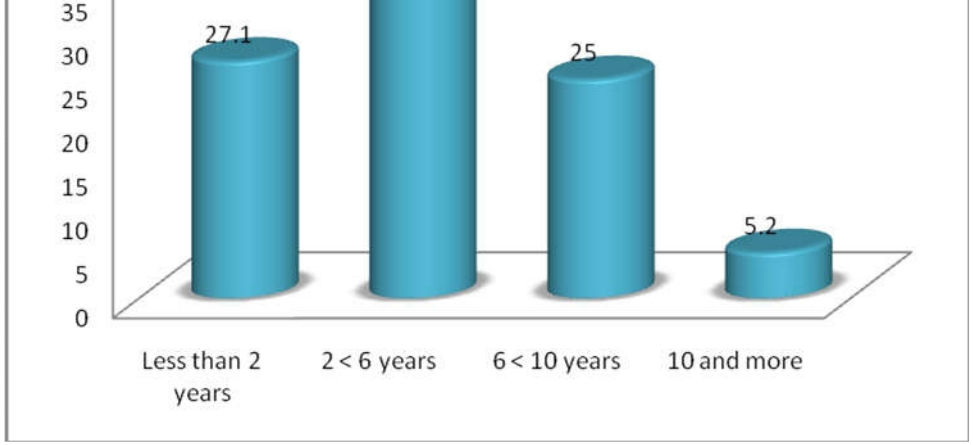


Figure (5) shows the distribution of the study group according to their years of experience.

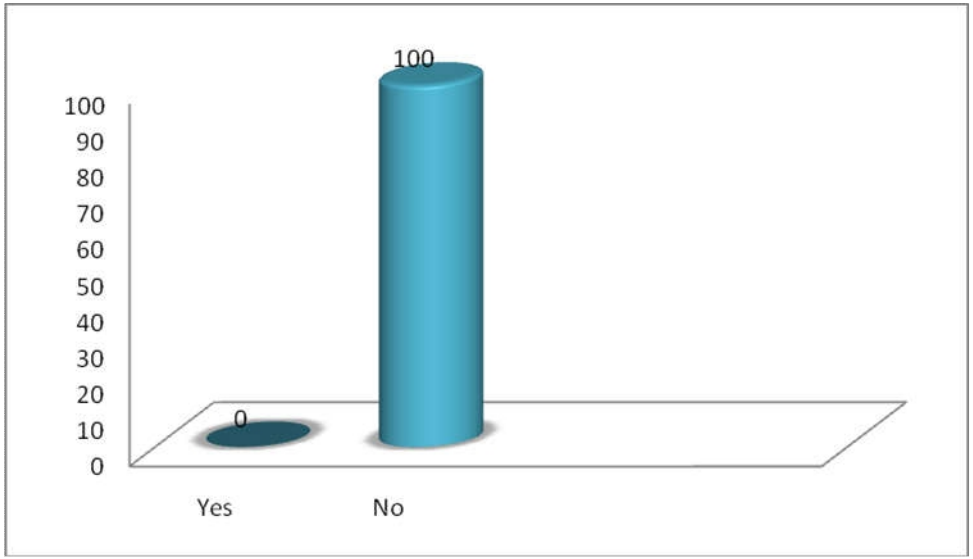


Figure (6) shows the study group attendance of training courses regarding pressure ulcer prevention.

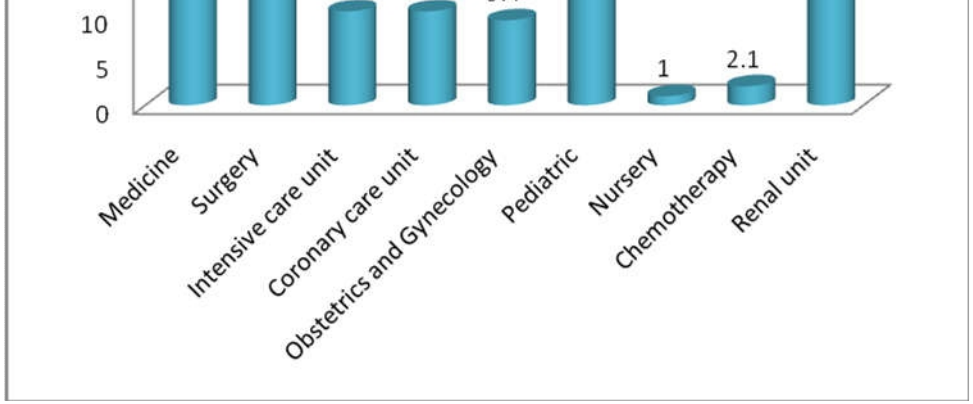


Figure (7) shows the distribution of the study group according to their work site.

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Meaning of pressure sore					
Localized injury caused by unrelieved pressure	22	22.9	65	67.7	.000
Damage of skin	51	53.1	25	26.0	
Inadequate blood supply	18	18.8	6	6.3	
Necrosis	5	5.2	0	0.00	
Total	96	100%	96	100%	
Other nomenclature for pressure ulcer					
Skin tear	46	47.9	1	1.0	.001
Break in the tissue	8	8.3	12	12.5	
Decubitus ulcer	3	3.1	80	83.3	
Lesion	39	40.7	3	3.2	
Total	96	100.0	96	100.0	

Table (1) showed that (22.9%) of study group had good knowledge about the definition of pressure ulcer in the preprogram testing, this percentage rises to (67.7%) in the post program test, with highly significant statistical value, (p- value = 0.000).

Regarding the knowledge of nomenclature of pressure ulcer only (3.1%) of study group was aware about that. After the interventional program their knowledge rises to (83.3%), with significant statistical value, (P value =

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Main causes of pressure ulcer					
Advance age	26	27.1	9	9.3	.003
Impaired blood circulation	20	20.8	6	6.3	
Pressure	32	33.3	74	77.1	
Unconsciousness	18	18.8	7	7.3	
Total	96	100.0	96	100.0	
Commonest age for pressure ulcer formation					
Adulthood	6	6.2	0	0.00	.000
Middle age	6	6.2	7	7.3	
Old age	41	42.8	11	11.5	
Elderly	43	44.8	78	81.3	
Total	96	100.0	96	100.0	

Table (2) showed that only (33.3%) of study group were aware about the main causes of pressure ulcer before conduction of the interventional program, after which their knowledge rises to (77.1%). With significant statistical value (P value = 0 .003)

Also the above table reveals that more than half of the study group (55.2 %) had poor knowledge about the commonest age liable to develop pressure ulcer before the conduction of the interventional program, after which (81.3%) became aware about that, with highly significant statistical value. (P

(n=96)					
Nurses knowledge	**Study group**				**P-value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Clients with urinary or fecal incontinence develop pressure sore due to					
Unrelieved pressure	7	7.3	7	7.3	.000
Moisture	46	47.9	73	76.0	
Friction	3	3.1	12	12.5	
Bacterial infection	40	41.7	4	4.2	
Total	96	100.0	96	100.0	
Client under shearing force develop pressure sore due to					
Friction and gravity	18	18.8	3	3.1	.000
Pressure and gravity	24	25.0	14	14.6	
Moisture and pressure	20	20.8	10	10.4	
Friction and pressure	34	35.4	69	71.9	
Total	96	100.0	96	100.0	
Development of pressure sores from wrong method of using bed pan occurs due to					
Moisture	54	56.3	16	16.7	.000
Gravity	8	8.3	3	3.1	
Shearing force	16	16.6	61	63.5	
Friction	18	18.8	16	16.7	
Total	96	100.0	96	100.0	

Table (3) showed that (52.1%) of the study group displayed poor knowledge about occurrence of pressure ulcer in client with urinary or fecal incontinence before conduction of interventional program, after which this percentage decrease to (24%), with significant statistical value (p value equal

with significant statistical value (P value equal .000).

Also table (3) showed that most of study group have poor knowledge about occurrence of pressure sores from wrong method of using bed pan in preprogram testing as only (16.6%), were aware about that, while their knowledge increased in post program testing to (63.5%), with significant statistical value (p value equal .000).

Nurses knowledge	Study group				P-value
	Pre test		Post test		
	Frequency	percent%	Frequency	percent%	
Lateral position					
Greater trochanter and hip	19	19.8	77	80.2	.000
Ears and back of scapula	32	33.3	9	9.3	
Abdomen and thigh	6	6.3	4	4.2	
Elbows and heels	39	40.6	6	6.3	
Total	96	100.0	96	100.0	
Supine position					
Nape of neck	26	27.1	11	11.4	.000
Elbows	15	15.6	6	6.3	
Thigh	11	11.5	7	7.3	
Sacral region	44	45.8	72	75.0	
Total	96	100.0	96	100.0	
Sitting position					
Shoulders	7	7.3	1	1.0	.026
Back	10	10.4	4	4.2	
Buttocks	75	78.1	88	91.7	
Sole	4	4.2	3	3.1	
Total	96	100.0	96	100.0	

Table (4) showed that more than three quarter (80.2%) of the study

when the client on the supine position before conduction of the program, while (75 %) defined it correctly after the intervention, with significant statistical value (p value equal .000).

Regarding the points of highest pressure when the client at the sitting position more than three quarter (78.1%) of study group had good knowledge before intervention, in contrast to 91.7% after intervention, with no statistical significance (p value equal .026).

Nurses knowledge	Study group				P – value
	Pre test		Post test		
	Frequency	percent %	Frequency	percent %	
First sign of pressure ulcer					
Open sore	7	7.3	5	5.2	.000
Burning sensation	13	13.5	68	70.8	
Blister and bluish discoloration in the skin	27	28.2	6	6.3	
Redness	49	51.0	17	17.7	
Total	96	100.0	96	100.0	
symptoms of stage III pressure ulcer					
Open ulcer with a red pink wound bed	21	21.9	13	13.5	.000
Subcutaneous fat may be visible	16	16.7	59	61.5	
Bone and tendon aren't exposed	5	5.2	13	13.5	
Shiny or dry shallow ulcer without slough or bruising.	54	56.2	11	11.6	
Total	96	100.0	96	100.0	
symptoms of unstageable/ Unclassified category of pressure ulcer					
Open ulcer	13	13.5	8	8.3	.003
Partial thickening	13	13.5	15	15.6	
Actual depth of the ulcer is obscured by eschar, depth cannot be determined	28	29.2	61	63.5	

significant statistical value (p value = 0.000).

Concerning knowledge about sign of stage three only (16.7%) were aware about it in pre intervention testing. The post intervention result shows an increase to (61, 5 %) with significant statistical value (p value = 0.000).

Regarding the sign of unstageable/ Unclassified category of pressure ulcer the study shows an improvement in the nurses knowledge from (29.2%) to (63.5%) after intervention with significant statistical value (p value = 0.003).

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Appropriate ways assessment for high risk patients to pressure ulcer					
Risk assessment scale	35	36.5	83	86.5	.000
Clinical judgment	28	29.2	8	8.3	
Physician's order	26	27.1	5	5.2	
Laboratory test	7	7.2	0	0.00	
Total	96	100.0	96	100.0	
Appropriate scale for high risk patients to pressure ulcer					
Head to toe scale	40	41.7	12	12.5	.002
Braden scale	13	13.5	79	82.3	
Glasgow coma scale	7	7.3	4	4.2	
Role of nines scale	36	37.5	1	1.0	
Total	96	100.0	96	100.0	

The above table showed that post interventional nurses knowledge score was (86.5%) regarding the appropriate assessment ways for high risk patients for pressure ulcer compared with pre interventional score which were only (36.5%), with highly significant statistical value (p value = 0.000).

Regarding the appropriate scale to be applied to assess the at high risk patients for pressure ulcer development, the study showed an improvement in the nurses knowledge from (13.5%) in pre interventional testing to (82.3%) after conduction of the interventional program with significant statistical value (p value = 0.002).

pressure ulcer.

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
frequency of skin assessment					
Daily	36	37.5	81	84.4	.000
Every two days	4	4.2	3	3.1	
Every three days	2	2.1	2	2.1	
Weekly	54	56.2	10	10.4	
Total	96	100.0	96	100.0	
Area for having more attention, while performing skin assessment					
Bony prominence	29	30.2	74	77.1	.000
Skin folds	10	10.4	7	7.3	
the back	54	56.3	10	10.4	
skin over flesh	3	3.1	5	5.2	
Total	96	100.0	96	100.0	

Table (7) showed that (37.5%) of the study group had good knowledge about frequency of skin assessment to prevent pressure ulcer before conduction of interventional program, after which this percentage rises to (84.4%), with significant statistical value (p value =.000).

Regarding the nurses knowledge about areas needing more attention, while performing skin assessment the pre program knowledge score was (30.2%) in contrast to (77.1%) in post program testing. with highly significant P value = 0.000.

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Vitamins needed to maintain healthy skin					
Vitamin D	27	28.1	14	14.6	.004
Vitamin C & A	30	31.3	75	78.1	
Vitamin K	17	17.7	3	3.1	
Vitamin B	22	22.9	4	4.2	
Total	96	100.0	96	100.0	
Nutrients needed to prevent bed sore in an elderly patients					
High fats	7	7.3	4	4.2	.000
High protein and high calorie	10	10.4	65	67.7	
High fiber diet	11	11.5	5	5.2	
high fats and fiber diets	68	70.8	22	22.9	
Total	96	100.0	96	100.0	

Table (8) shows that (31.3%) of the study group had good knowledge about vitamins needed for maintaining healthy skin before conduction of interventional program, after which this percentage rises to (78.1%). with significant statistical value (p value =.004).

Also the table showed that only (10.4%) of the study group had good knowledge about nutrients needed for prevention of bed sore in an elderly patients before conduction of interventional program, in contrast to (67.7%) after conduction of the program, with significant statistical value (p value

(n=96)					
Nurses knowledge	**Study group**				**P – value**
	Pre test		**Post test**		
	Frequency	**percent %**	**Frequency**	**percent %**	
Frequency of cleaning the skin of a client with urinary or fecal incontinences					
Every half an hour	17	17.7	8	8.3	.000
Once in two hours at regular interval	38	39.6	11	11.5	
Once in four hours at regular interval	12	12.5	10	10.4	
During time of soiling and at regular interval	29	30.2	67	69.8	
Total	96	100.0	96	100.0	
Agent used for the skin cleaning					
Herbal soap	13	13.5	5	5.2	.000
Cream based soap	24	25.0	20	20.8	
Antiseptic lotion	51	53.2	12	12.5	
Mild detergent	8	8.3	59	61.5	
Total	96	100.0	96	100.0	

Also the above table revealed that only (8.3%) of the study group had good knowledge about agent to be used for cleaning the skin, before conduction of the interventional program, compared with post program results (61.5%), with significant statistical value (p value =.000).

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Frequency of changing position of a client confined to bed is once					
Every two hours	77	80.2	91	94.8	.024
Every three hours	9	9.4	1	1.0	
Every four hours	7	7.3	2	2.1	
Every six hours	3	3.1	2	2.1	
Total	96	100.0	96	100.0	
Frequency of changing position of a client confined to chair					
Hourly	30	31.3	88	91.7	.000
Every two hours	41	42.6	6	6.3	
Every three hours	4	4.2	1	1.0	
Every four hours	21	21.9	1	1.0	
Total	96	100.0	96	100.0	

Table (10) demonstrated that (80.2%) of the study group were aware about frequency of changing position of a client confined to bed, this percentage increased to (94.8 %) after intervention, with no statistical significance (P value =0.024).

Also this table showed that (31.3%) of the study group had good knowledge about frequency of changing position of a client confined to chair before the interventional program, compared with the post interventional testing results (91.7%), with highly significant P- value (P=0.000).

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Main purposes of back care					
Improve circulation	29	30.2	14	14.6	.001
Prevent skin breakdown	9	9.4	4	4.2	
Promote soothing effect	6	6.2	3	3.1	
All above	52	54.2	75	78.1	
Total	96	100.0	96	100.0	
Position to be used for back care					
modified lateral position	36	37.5	14	14.6	.000
flowers position	19	19.8	4	4.2	
Prone position	9	9.4	5	5.2	
sitting or lateral position	32	33.3	73	76.0	
Total	96	100.0	96	100.0	
Agent to be used during back massage					
Lubricant or lotion.	27	28.1	71	74.0	.000
Ointment	19	19.8	8	8.3	
Talk powder	42	43.8	16	16.7	
Iodine	8	8.3	1	1.0	
Total	96	100.0	96	100.0	

significant statistical value (p value equal 0.001).

Regarding the position to be used for back care only (33.3%) of the study group had good knowledge about it, compared with76% in post program testing, with significant statistical value (p value equal 0.000)

Also the table showed that (28.1%) of the study group had good knowledge about agent to be used during the back massage before intervention, while after intervention program (74%) of them showed good knowledge with highly significant P value = 0.000).

(n=96)					
Nurses knowledge	**Study group**				**P –value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Pressure relieving devices					
Air mattress	60	62.5	12	12.5	.000
Cushions	7	7.3	3	3.1	
Water mattress	2	2.1	1	1.0	
All above	27	28.1	80	83.4	
Total	96	100.0	96	100.0	
In supine position pillows should be placed in					
Under head, hands, arms, lower back and lower legs	28	29.1	66	68.8	.000
Under head, between legs and back	23	24.0	12	12.5	
Under head , shoulder and between legs	21	21.9	8	8.3	
Under hands, shoulder, back and legs	24	25.0	10	10.4	
Total	96	100.0	96	100.0	
In lateral position, pillows should be placed					
Under head, at the back and between legs	25	26.0	8	8.3	.003
Under head, upper arm, upper legs and at the back	19	19.8	74	77.1	
Under upper arm, at the back and between legs	26	27.1	7	7.3	
Under head, upper arm, and between	26	27.1	7	7.3	

statistical value (p value equal 0.000).

About placing of pillows when the patient in supine position only (29.1%) of the study group showed good knowledge about it in pre program testing while this knowledge increased in post program to (68.8%), with significant statistical value (p value equal 0.000)

Also this table shows that only (19.8%) of the nurses had good knowledge about placing of pillows when patient in the lateral position before intervention, compared with 77.1 in post interventional testing, with highly significant P value = 0.003.

(n=96)					
Nurses knowledge	**Study group**				**P – value**
	Pre test		**Post test**		
	Frequency	**percent %**	**Frequency**	**percent%**	
An appropriate nursing care for managing mechanical load					
Elevating the head of bed at 30o	17	17.7	9	9.4	.000
Cleaning soil	12	12.5	8	8.3	
use lubricant and lotion	32	33.3	8	8.3	
Turning position.	35	36.5	71	74.0	
Total	96	100.0	96	100.0	
An appropriate nursing activity to reduce friction					
Elevating the head of bed greater than 30^o	24	25.0	5	5.2	.003
Lifting patient without dragging	15	15.6	75	78.1	
placing pressure relieving devices	26	27.1	7	7.3	
Elevating the head of the bed at 90^o	31	32.3	9	9.4	
Total	96	100.0	96	100.0	
An appropriate nursing activity to reduce shearing force					
Elevating the head of bed < 30^o	27	28.1	4	4.2	.002
Elevating the head of bed at 30^o	24	25.0	84	87.5	
Elevating the head of bed at 60^o	16	16.7	5	5.2	
Elevating the head of bed at 90^o	29	30.2	3	3.1	
Total	96	100.0	96	100.0	

post program to (74%), with significant statistical value (p value equal 0.000).

Regarding the appropriate nursing measures to be applied to manage friction only (15.6%), of the study group had good knowledge about that in pre interventional testing, while this knowledge rises in post program to (78.1%), with significant statistical value (p value equal 0.003)

The table also demonstrated that only (25%) of the study group had good knowledge about the appropriate nursing measures to be applied to manage shearing force before intervention, while this percentage increased to 87.5% in post interventional testing, with highly significant P value = 0.002.

(n=96)					
Nurses knowledge	**Study group**				**P – value**
	Pre test		**Post test**		
	Frequency	**percent%**	**Frequency**	**percent%**	
Exercise prevents pressure ulcer through					
Improving blood circulation	35	36.5	70	72.9	.000
Providing energy	18	18.7	3	3.1	
Preventing tissue damage	35	36.5	21	21.9	
Promoting soothing effect	8	8.3	2	2.1	
Total	96	100.0	96	100.0	
Most serious complication of pressure sore					
Marjolin ulceration	6	6.2	4	4.2	.000
Blister formation and systemic infection	4	4.2	2	2.1	
Sepsis	21	21.9	76	79.2	
gas gangrene	65	67.7	14	14.6	
Total	96	100.0	96	100.0	

table (14) demonstrated that (21.9%) of the study group had good knowledge about most serious complication of pressure sore in pre program testing, compared with 79.2& in post interventional testing, with highly significant P-value (P=0.000).

Section3: nurses practice of pressure ulcer and its prevention:

Table (15) shows the distribution of the study group according to their performance regarding observation of how other nurses assess risk factors of pressure ulcer, identify common contributing factors and do skin assessment guided by a standard nursing care protocol available in her/his hospital.

(n=96)													
Procedure	**Almek Nimir Hospital**												**p-value**
	Preprogram						**Post program**						
	Never		**Sometimes**		**Always**		**Never**		**Sometimes**		**Always**		
	F.	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	
1. The nurse observes how other nurses assess risk factors of pressure ulcer development.	55	57.3	19	19.8	22	22.9	8	8.3	14	14.6	74	77.1	.000
2. The nurse identifies common contributing factors for pressure ulcer development by periodical assessment of patient's skin.	49	51.0	21	21.9	26	27.1	18	18.8	17	17.7	61	63.5	.000
3. The nurse does skin assessment that guided by a standard nursing care available in her/his hospital.	75	78.1	10	10.4	11	11.5	12	12.5	12	12.5	72	75.0	.000

.In the post intervention results (77.1%) became always observing how other nurses assess risk factors of pressure ulcer development and (8.3%) are still never performing it, with significant statistical value (p value equal .000).

Only (27.1%) of the study group always identify the common contributing factors for pressure ulcer development by patient's skin assessment while there was increase to (63.5%) after the interventional training program. Also only (11.5%) always do the skin assessment guided by a standard nursing care protocol in pre program results, and this percentage also increased after interventional training to (75%)) with significant p value = .000).

Table (16) shows the distribution of the study group according to their performance regarding the use of risk assessment scale to assess pressure ulcer, the performance of skin care as a routine work of her/his unit and placing the pillow under the patient's leg to prevent heel ulcer.

(n=96)													
Procedure	**Almek Nimir Hospital**												**p-value**
	Preprogram						**Post program**						
	Never		**Sometimes**		**Always**		**Never**		**Sometimes**		**Always**		
	F.	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	
4. The nurse uses risk assessment scale to assess pressure ulcer.	96	100	0	0.00	0	0.00	66	68.8	0	0.00	30	31.2	.000
5. The nurse performs skin care as a routine work of her/his unit.	64	66.6	21	21.9	11	11.5	25	26.0	11	11.5	60	62.5	.000
6. The nurse places the pillow under the patient's leg to prevent heel ulcer.	58	60.5	13	13.5	25	26.0	20	20.8	9	9.4	67	69.8	.000

testing, while (31.3%) of the study group used it in post interventional phase, with statistically significant value (P=0.000).

The table again showed only (11.5%) of the study group always perform routine skin care for the patients in pre program testing, while this percentage increased to (62.5%) after conduction of the interventional training program.

The table also revealed that only (26.0%) of the study group always place the pillows under the patient's leg to prevent heel ulcer in pre program testing while in post interventional testing this percentage increased to (69.8%), with significant p value = 0.000.

Table (17) shows the distribution of the study group according to their performance regarding advising the caregiver to use creams or oils on patients' skin in order to protect it from urine, stool or wound drainage, paying more attention to pressure points during cleansing the feces or maceration and monitoring proteins and calories in the diet of bedridden patients.

(n=96)													
Procedure	**Almek Nimir Hospital**												**p-value**
	Preprogram						**Post program**						
	Never		**Sometimes**		**Always**		**Never**		**Sometimes**		**Always**		
	F.	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	
7. The nurse advices caregiver to use creams or oils on patients' skin in order to protect from urine, stool or wound drainage.	72	75.0	6	6.2	18	18.8	14	14.6	4	4.2	78	81.3	.000
8. The nurse pays more attention to pressure points during cleansing the feces or maceration.	70	72.9	5	5.2	21	21.9	18	18.8	7	7.2	71	74.0	.000
9. The nurse observes proteins and calories in bedridden patient diet.	76	79.2	0	0.00	20	20.8	22	22.9	0	0.00	74	77.1	.000

Table (17) revealed that (75.0%) of the study group had never advised the caregiver to use creams or oils on patients' skin in order to protect it and only (18.8%) always do it in pre program testing. After conduction of the interventional program (81.3%) became always advising the caregiver to use creams or oils on patients' skin and (14.6%) never did it, with significant statistical value (p value = .000)).

The table also showed that (72.9%) of the study group had never paid more attention to pressure points, and only (21.9%) always do it in preprogram testing. After the interventional training program (74.0%) became always doing it and (18.8%) not yet, with significant statistical value (p value = .000).

(20.8%) of the study group were found to be always observing proteins content and calories of the diet of the bedridden patient in pre program testing, compared with (77.1%) in the post interventional training program testing, with significant p value = .000.

Table (18) shows the distribution of the study group according to their performance regarding avoidance of dragging the patients during repositioning, use of special mattress to prevent pressure loadings and performance of back massage to the patient to prevent pressure ulcer formation.

(n=96)													
Procedure	**Almek Nimir Hospital**												**p-value**
	Preprogram						**Post program**						
	Never		**Sometimes**		**Always**		**Never**		**Sometimes**		**Always**		
	F.	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	
10. The nurse avoids dragging the patients during repositioning.	60	62.5	0	0.00	36	37.5	26	27.1	0	0.00	70	72.9	.000
11. The nurse uses a special mattress to prevent pressure loadings.	34	35.4	35	36.5	27	28.1	20	20.8	14	14.6	62	64.6	.000
12. The nurse do back massage to the patient to prevent pressure ulcer formation.	96	100	0	0.00	0	0.00	68	70.8	0	0.00	28	29.2	.000

Table (18) showed that there is improvement in nurses performance regarding the avoidance of dragging the patients during repositioning, as there were (62.5%) of the study group never avoid it in pre intervention phase, compared with (72.9%) in post program testing always avoided it, with statistically significant value (P=0.000).

The table also showed that (28.1%) of the study group always use a special mattress to prevent pressure loading in pre program testing, while in the post program testing this percentage increased to (64.6%). And no one (0.00%) found to do back massage to the patient in pre program testing after which this percentage increased to (29.2%) in post program testing with significant p value = 0.000).

Table (19) shows the distribution of the study group according to their performance regarding the use of (ring) cushion to prevent pressure ulcer formation, changes of the patient position every two hour, giving advice to the patient or caregiver and documentation of all data related to pressure ulcer assessment.

(n=96)													
Procedure	**Almek Nimir Hospital**												**p-value**
	Preprogram						**Post program**						
	Never		**Sometimes**		**Always**		**Never**		**Sometimes**		**Always**		
	F.	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	**F.**	**%**	
13. The nurse uses (ring) cushion to prevent pressure ulcer formation.	96	100	0	0.00	0	0.00	72	75.0	0	0.00	24	25.0	.000
14. The nurse turns patient position every two hour.	37	38.5	32	33.4	27	28.1	23	24.0	6	6.2	67	69.8	.000
15. The nurse gives advice to the patient or caregiver regarding pressure ulcer preventive care before discharge the patient	51	53.1	22	22.9	23	24.0	19	19.8	15	15.6	62	64.6	.000
16. The nurse documents all data related to pressure ulcer assessment.	96	100	0	0.00	0	0.00	50	52.1	0	0.00	46	47.9	.000

Table (19) showed that there was improvement in nurses performance regarding the use of donut-shape (ring) cushion to prevent pressure ulcer formation, as there was no any nurse used it (0.00%) in the pre interventional phase, while (25%)of the study group always use it in post interventional phase, with statistically significant P value (P = 0.000).

It was also shown that (38.5%) of the study group never used to turn patient position every two hours and only (28.1%) always do it in pre program result. After conduction of the program (69.8%) become always doing it, with statistically significant P value = .000).

It was also found that only (24.0%) of the study group always give advice to the patient or caregiver regarding pressure ulcer prevention care before discharge in pre program testing, while this percentage after interventional training program increased to (64.6%). Regarding documentation, no one (0.00%) was documenting all data related to pressure ulcer assessment in pre program testing compared with(47.9%) after conducting the interventional training program, with statistically significant P value = 000.

5.1. Discussion

Nurses are in direct contact and relationship with patients in different wards and units during the day and night. Therefore they need high level of knowledge and skills in practice to provide high quality nursing care for the thick patients. This study was designed to assess the impact of Structured Teaching Program on nurse's knowledge and practice regarding pressure ulcer and its prevention among staff nurses working at Almek Nimir hospital.

The objectives of this study is to reduce the incidence of pressure ulcer among patients admitted to Almek Nimir Hospital, by assessing the need of nurse's knowledge and practice regarding pressure ulcer prevention, then design an interventional program according to their needs and evaluate the effectiveness of the implementation of the program.

This study included 96 nurses from Almek Nimir university hospital, and the results showed that the most of the participants (78.1%) age ranged between 22 to < 30. And (42.7%) of the participants had a working experience of 2 to < 6 years, (27.1%) less than 2 years, (25%) 6 to < 10 years and only (5.2%) had a working experience of 10 years and more. This short periods of experiences is due to the fact that the hospital is newly established, the nursing staff usually are select from new graduates of the University of Shendi. In addition to this Shendi is small peripheral town which is not preferred by the nurses as they prefer big central towns where they can increase their income by working additional working hours in private hospitals and medical centers. Also the migration of highly qualified and experienced staff is one of the most important factors affecting the quantity and quality of the hospitals staff in the whole country.

(87.5%) of the participants were female as most of the graduates of nursing schools are female because traditionally this profession is considered a female, although this concept had been changed during the last years. More

than half of study group were single (54.2%) while (44.8%) were married and this because most of them are still young and recently graduated. The majority of the participants (75.0%) had Bachelor of nursing and (25.0%) had master degree, and that is due to newly established of Doctor of Philosophy in Shendi University (2008). None of the participants had attended any in-service workshop or any educational program regarding the issue of this study. Which contributing to the lack of nurses' knowledge revealed in the current study.

The distribution of the participants among the departments and sections of the hospital is as follow: (21.9%) were having experience in general medical wards, surgical wards (16.7%), renal unit (15.6%), pediatric ward (12.5%), intensive care unit and Coronary care unit (10.4%) each, obstetrics and gynecology (9.4%), chemotherapy (2.1%) were having and only (1.0%) in the nursery.

The present study shows that only (22.9%) of the participants were able to define pressure ulcer correctly and minority of them (3.1%) were aware about other nomenclature of pressure ulcer before intervention and this is probably due absent of educational program or activity was conducted in the hospital regarding pressure ulcers. After conduction of the educational program this percentage increased to (67.7%) and (83.3%) respectively, with significant statistical test (p value < 0.05). Similar fact was proved by an study conducted in Swedish healthcare to assess knowledge, attitude and practice of nursing staff regarding pressure ulcer prevention; where they found that nurses who had training were more knowledgeable than those who did not.[157] This might be due to the fact that educational programs and training give the chances for the trainees to be up to date regarding knowledge and practice concerning pressure ulcer.

Also the knowledge of the participants regarding to the main causes of pressure ulcer was poor as only (33.3%) of study group were able to

recognize them before the educational program after which this percentage increased to (77.1%) in posttest, with (P value = 0 .003). The reference knowledge used was that: There are four main factors implicated in the pathogenesis of pressure ulcers – pressure, shear force, friction and moisture, with pressure being the most important etiological factor.[30]

The study revealed that (44.8%) of the participants have poor knowledge concerning the elderly age group as the most commonest age liable to develop pressure ulcer. This percentage increased to (81.3%), after educational program with statistically significant value (P value = 0 .000). The reference knowledge used was that: The elderly are at an increased risk of developing pressure ulcers, with a cumulative incidence for pressure ulcers of a Stage II severity or higher being estimated at 12.9% in elderly people hospitalized for periods of up to 8 weeks for an acute event.[41]

The present study revealed that (52.1%) of the study group had poor knowledge about occurrence of pressure ulcer in client with urinary or fecal incontinence before the education program, this percentage decreased to (24%) in post program testing, with significant statistical value (P value = 0 .000). Regarding this concern the review of the literature showed that the incontinence, sweating, or leaking wounds were the possible risk factors for patients admitted in ICU unit. Exposure to moisture in the form of urine, feces, perspiration, and drainage from fistula or wound for prolonged period reduces the resistance of the skin for forces such as friction. [31]

Only (35.4%), of the study group were aware about occurrence of pressure ulcer in client exposed to shearing force in preprogram results. Post program results showed an increase in this percentage as (71.9%) of the study group became aware about that, with statistically significant value (P value = 0 .000). this result is supported by study conducted by Kurian, 2003 , concluded that educational knowledge of immobilized orthopedic patients and

their caregivers regarding prevention of complications related to immobilization, including pressure ulcer, were effective to prevent complications of immobilization.[158]

In regards to the occurrence of pressure sores from wrong method of using bedpan the study reveals that most of study group have poor knowledge about that in preprogram testing as only (16.6%) were aware about that, while this percentage increased in post program to (63.5%), with significant statistical value (p value = 0.000). Also there was much change in the knowledge of nurses regarding to the highest points of pressure when the client on lateral, supine and sitting position as (19.8%), (45.8%) and (78.1%) respectively in preprogram results, and these percentage increased to (80.2%), (75%) and (91.7%) respectively in post program testing, which indicate that intervention had positive effect on knowledge of pressure ulcer with significant statistical test (p value < 0.05). these results were supported by Moody BL et al (1988) conducted study on impact of staff education on pressure sore development in elderly hospitalized patients. The incidence of development of pressure sores among patients over the age of 65 years was concurrently reviewed before and after the education program developed and disseminated by skin care tears compared of physicians and Nurses. The data showed that educational program was effective in decreasing by 63% the development of pressure sores in an elderly hospitalized population.[159]

There is improvement in the knowledge of the participants regarding the first sign of pressure ulcer as in preprogram testing only (13.5%) were aware about it in contrast to the post program checking where this awareness rises to (70.8%). Also there was improvement in the knowledge of nurses towards the sign of stage three as only (16.7%) of the study group were aware about it in preprogram testing, while in post intervention results this percentage increased to (61,5%). Regarding to the sign of unstageable/ unclassified category of pressure ulcer the study showed improvement in the

participant's knowledge from (29.2%) to (63.5%) after intervention. The study showed an increase of knowledge for different signs of the different stages after the conduction of program with significant statistical value (P value <0.05). This is explained by the lack of teaching programs and in-service training regarding prevention of pressure ulcer. This result is consistent with Pieper B, Mott M (1995) on "Nurses knowledge of pressure sore ulcer presentation, staging and description". The purpose of this study was to examine registered nurses (N=228) knowledge of pressure ulcer presentation, staging and wound description A 47 item questionnaire was developed. Nurse's knowledge was found to be significantly higher the more recently they had heard a lecture or read an article about pressure ulcers. Knowledge scores were not related to educational background, age, or years of work experience.[160]

Regarding to appropriate nursing way and scale to be used to assess patients at high risk for pressure ulcer, present study shows significant improvement in nurses knowledge in post interventional program, as only (36.5%) of the study group were aware about appropriate nursing way to assess patients at high risk for pressure ulcer in preprogram result increased to (86.5%) post program, and only (13.5 %) of the study group were aware about appropriate nursing scale used to assess patients who are at high risk for pressure ulcer in pre test phase, increased to (82.8%) post program result. with highly significant value (p – value < 0.05). which is supported by Mrs Vandana Pakhide (2013) conducted study focused on assessment of the knowledge level of staff nurses on prevention of pressure ulcer by using Braden scale. **Methods**: The sample for the present study comprised of 30 staff nurses who met the inclusive criteria. Assessed pre-test knowledge level with structured questionnaire, all the respondents had poor practice of pressure ulcer risk assessment and its prevention. Administered structured teaching program and post assessment was done. **Results**: showing the

effectiveness of structured teaching program at 0.05 level and 0.01 levels of significance.[161]

Regarding the nurses knowledge about frequency of skin assessment to prevent pressure ulcer the pretest knowledge score is (37.5%) and this increased to (84.4%) in post educational program test. Also knowledge of areas to have more attention, while performing skin assessment the pretest knowledge score was (30.2%) and in post program test increased to (77.1%), with high statistical significance (P value < 0.05). Reference knowledge for this purpose states that: Although pressure ulcers can develop at any site, they occur more frequently over bony prominences, as previously mentioned. Patient position and degree of immobility can influence the site of involvement. The most common locations are the sacrum, coccyx, and heels (when persons are in a supine position); the hips and ankles (when persons are lying on their sides); and the buttocks (when persons are seated). Less commonly involved are the earlobes, occiput, chin, elbow, scapula, and knee. The lower half of the body accounts for 95% of pressure ulcers.[68,69]

The study showed improvement in the knowledge of the participants regarding vitamins needed for maintaining healthy skin, after implementation of the program, as only (31.3%) of the study group were aware about that in pretest, in contrast to (78.1%) in post test with highly significant P – value (P - value < 0.05). Also only (10.4%) of the study group were aware about nutrients needed to prevent bed sore in an elderly patients, and this awareness rises to (67.7%) in post test score with highly significant P- value (P value < 0.05). This result is supported by the work of Nasibeh Vatankhah **et. Al.** who used study conducted in the Tehran, Iran regarding the effectiveness of foot care education on people with type 2 diabetes mellitus and the aim was to evaluate the impact of simple educational program on knowledge and practices and the study design was structured interview and 148 participants were selected. The results showed that the applied educational intervention

has improved their knowledge and practice about diabetic foot care and they concluded that a simple face to face education is an effective and applied method to improve the knowledge about foot care. [162]

The present study demonstrated that around one third of study group (30.2%) were aware about Frequency of cleaning skin of a client with urinary or fecal incontinences, this percentage increased to (69.8%) after intervention. Also the study showed that only (8.3%) of the participants had good knowledge about agent used for skin cleaning before intervention, with improvement after intervention to (61.5%), with highly significant P- value (P value < 0.05).This results are supported by Salwa A. Mohamed , Soheir M. Weheida (2014), whom reported that nursing staffs' knowledge and practice about pressure ulcer preventive measures could be improved. Participants in the study reported that they could use the educational program effectively and easily in the prevention of pressure ulcers among their immobilized patients, which decreases the occurrence of pressure ulcers and as well as improved patient outcome.[163]

In Regards to changing the position of a client confined to bed or chair, (80.2%) of study group were aware about frequency of changing the position of a client confined to bed in preprogram testing. This increased to (94.8%) after intervention with (P value < 0.024). But only (31.3%) of the participants had good knowledge about frequency of changing position of a client confined to chair before intervention, with improvement after intervention to (91.7%), with highly significant (P value < 0.05). The literature used as reference for this part of the study states that: Posting an individualized turning schedule in patient rooms can be helpful to healthcare professionals and patients. If the individual is to remain in bed, his or her position should be changed regularly and at least every two hours (although this should be adjusted to suit individual requirements as some patients may need more frequent intervention than others). Patients should be rested at a 30-degree tilt

and on alternate sides to avoid prolonged pressure at bony prominences.[116] Chair bound patients require special attention to positioning as well. The risk of pressure ulcers from prolonged sitting is greater than that from reclining in bed, as sitting puts the patient's weight on the relatively small surface areas of the buttocks, thighs, and soles of the feet. Much of this weight is centered over the small area of tissue covering the ischial tuberosities. It is important for patients who sit in a chair to regularly change position. A dependent patient must have his/her position changed in a chair at least every hour. Patients who are able to move themselves should shift their weight (even slightly) every 15 minutes.[117]

The present study revealed that more than half of the study group have good knowledge about all main purposes of back care in preprogram testing (54.2%), in contrast to post program where it increased to (78.1%), with significant statistical test (P value < 0.05). Also the study showed that (33.3%) of the study group had good knowledge about position used for back care before the educational program after which this percentage increased in post program to (76%), with significant statistical test (P value < 0.05). Furthermore the present study demonstrated that only (28.1%) of the nurses had good knowledge about agent used during the back massage before intervention, with improvement after intervention to (74%), with significant statistical test (P value < 0.05). These results are supported by Garber SL and etal .(2002) who conducted study about A structured educational model to improve pressure ulcer prevention knowledge in veterans with spinal cord dysfunction. The study reveal that: Enhanced, individualized education about pressure ulcer prevention and management was effective in improving pressure ulcer knowledge during hospitalization for surgical repair of a pressure ulcer.[164]

Concerning knowledge of nurses regarding to all types of pressure relieving devices, this study found that (28.1%) of the study group had good knowledge about that in preprogram testing while this percentage increased in post program to (83.4%) with P value < 0.05. and only (19.8%) of the nurses had good knowledge about placing of pillows when patient in lateral position before intervention, this percentage increased after intervention to (77.1%), with highly significant P value < 0.05). Also (29.1%) of the nurses had good knowledge about placing of pillows when patient in supine position before intervention, with improvement after intervention to (68.8%) These results are supported by Defloor T. De Bacquer D, Grypdonck MH (2005) who conducted study on the effect of various combinations of turning and pressure reducing devices on the incidence of pressure ulcers. Turning is considered to

be an, effective way of preventing pressure ulcers, however almost no research has been undertaken on this method. The aim of the study was to investigate the effect of four different preventative regimes involving either frequent turning (2,3 hourly) or the use of a pressure – reducing mattress in combination with less frequent turning (4,6 hourly). 838 geriatric nursing home patients participated in the study. During 28 days, four different turning scheme were used; turning every 2h on a standard institutional mattress (n=65), turning every 3 h on a standard institutional mattress (n=65), turning every 4h on a visco elastic foam mattress (n=67), and turning every 6h on a standard institutional mattress (n=65). The remaining patients (n=576) received standard preventive care. The incidence of non-blanchable erythema (34.8-38.1%) was not different between these groups. The incidence of grade II and higher pressure ulcers in the 4th interval group was 3.0% compared with incidence of grade II and higher pressure ulcers in the 4th interval group was 3.0% compared with incidence figures in the other groups varying between 14.3% and 24.1%. The study revealed that turning every 4h on a visco elastic foam mattress resulted in a significant reduction in the number of pressure ulcer lesion and makes turning a feasible preventive method in terms of effort and cost.[165]

Furthermore, the present study indicated that, nurses knowledge had been improved regarding the appropriate nursing measure for managing the mechanical load, because in pretest phase (36.5%) of the study group had good knowledge about this, while this percentage increased in post program to (74%), with significant statistical test (P value < 0.05). Moreover the study revealed that there was improvement in the participants knowledge about the appropriate nursing activity to reduce friction as only (15.6%), of the study group had good knowledge about that in pre educational program testing, in contrast to post program test where (78.1%) of them showed good knowledge,

with significant statistical test (P value < 0.05). Also concerning the appropriate nursing measures to reduce shearing force the study show that only (25%) of the participant had good knowledge before intervention. This percentage increased after intervention to (87.5%), with highly significant statistical test (P value < 0.05).The basic information concerning this states that: Immobile and inactive individuals were exposed to the forces of shear and friction due to lifting, turning, and positioning over bony prominences. Friction was experienced during repositioning and during dragging over the rough surface of the bed linen. To avoid friction, proper lifting and manual handling techniques should be employed. Turning devices, slide sheets and slide boards may be used during lifting and transferring.[111] Skin should be protected with padding or protective dressing of hydrocolloids or transparent films. The force of shear can be reduced by elevating the foot of the bed by 10 to 20 degree. This helps to prevent sliding when sitting or semi-recumbent. The head of the bed should also be maintained at the lowest possible elevation no greater than 30 degree according to individuals' medical condition and comfort.[121]

Regarding the role of exercise in preventing pressure ulcer, (36.5%) of the study group were aware about it in preprogram testing. This percentage increased to (72.9 %) after intervention with (P value < 0.05). The literature used as the base knowledge for this part of the study states: Mobilization and activity alter pressure on weight bearing areas, relieve stressed or damaged tissue and improve circulation. Individuals should be encouraged to maximize activity and mobilization in accordance with their medical condition, ability, and energy level. Health care team can use devices, such as trapeze, cot sides, cane, walker or handrails to assist individual to increase their activity and mobilization.[33]

Also the present study shows that (21.9%) of the participants had good knowledge about most serious complication of pressure sore, this percentage increased after intervention to (79.2%), with highly significant statistical test (P value < 0.05). The literature used as the base for this part of the study states: Sepsis is of the most serious complications of pressure ulcers. When bacteria present in the wound enter the bloodstream, systemic inflammatory response syndrome (SIRS), septic shock, and multi-organ failure can result. This cascade of events can ultimately lead to death.[140.141]

Concerning the participants practice, the study shows an improvement in their performance regarding the observation of how other nurses assess risk factors of pressure ulcer, after the interventional program, as (57.3%) of the participants never do it before intervention. This percent decrease to (8.3%) and (77.1) of the study group become always doing it with statistical significant difference (P value < 0.05). Regarding the identification of the common contributing factors for pressure ulcer development by periodical assessment of patient's skin, the study shows an improvement of the participant's performance after the interventional program, as Only (27.1%) of the study group always identify the common contributing factors for pressure ulcer development by patient's skin assessment in preprogram testing in contrast to (63.5%) after interventional training program. Again only (11.5%) always do skin assessment guided by a standard nursing care in pre program results and this also increased after interventional training to (75%) with p value = .000). Moreover, the present study show that there was improvement in nurses performance regarding skin assessment that guided by a standard nursing care available in his/her hospital, after the interventional program, as Only (11.5%) of the study group always performed routine skin care for the patients in pre program results, in contrast to (62.5%) after interventional training program. Also only (26.0%) always placed the pillows

under the patient's leg to prevent heel ulcer in pre program results compared wih 69.8% after interventional training with statistically significant test (P value < 0.05). This result can be explained by Shortage of nurses and work over-loads and lack of nursing leadership. This study results are supported by Gunningberg L (2004) who conducted study on evaluation of an education program for Swedish nurses. 20 registered nurses were selected and quasi experimental design was used. Data was collected immediately before and after the education program (i.e., pre and post). The education program succeeded in encouraging and empowering nurses to change their clinical practice.[166]

Concerning the study group practice regarding the use of risk assessment scale to assess pressure ulcer occurrence, the present study shows that there was no any one of the study group who used the risk assessment scale (0.00%) pre interventionally, while (31.3%) of the study group used it after the intervention. This can be explained by lack of evidence based nursing practice and in-service training on prevention of pressure ulcer. Similarly the study conducted by Sharp C et. al (2000) in Sydney found that 79 % of the nurses did not use any assessment tool to identify patients at risk of pressure ulcer.[167]

The current study shows that the participants practice regarding the performance of skin care as a routine work was unsatisfactory before implementing the educational program, as (66.6%) of the study group never did it in preprogram testing. This can be explained by Shortage of nurses and work over-load and lack in-service training on prevention of pressure ulcer. After conduction of the program the result showed improvement in participants practice as (62.5) of the them always did it with statistically significant test (P value < 0.05). This finding congruent with Nurhusien Nuru and etal (2015) Knowledge and practice of nurses towards prevention of

pressure ulcer and associated factors in Gondar University Hospital, Northwest Ethiopia, and their results concluded that Knowledge and practice of the nurses regarding prevention of pressure ulcer was found to be inadequate. Having higher educational status, attending formal training and being experienced were positively associated with knowledge; while shortage of facilities and equipments, dissatisfaction with nursing leadership and inadequate staff number showed negative association with practice of nurse's pressure ulcer prevention. In-service training and upgrading courses are some of the important steps to improve nurses' knowledge and practice on prevention of ulcer pressure.[168]

Despite the fact that the nurses usually place pillow under the patient's leg to prevent heel ulcer, (60.1%) of study group never did that before intervention. The post program results showed an increase in this percentage, as (69.8%) always did it, with significant statistical test (P value < 0.05). Also there was no any participant used donut-shape (ring) cushion to prevent pressure ulcer formation in pre intervention phase, and only (25%) of them used it post intervention, with statistically significant test (P value < 0.05). This is due to the lack of this instrument in Almek Nimir hospital for this reasons the nurses had no good idea about it. These results are consistent with Carlowe (1998) who conducted study on all district nursing teams in one community in south East England. Baseline audit results showed that (47%) of patients had pressure sores for more than one year. After three years of establishment of educational workshops for all staff and multi disciplinary management group the pressure sore incidence declined to (7%) of patients developing pressure sore in a year. Therefore it was clear that the new policy made the service more cost effective and reduced the number of patients developing pressure sores. [169]

Also this study shows that three quarter (75%) of the nurses never adviced patients about benefits of using cream or oils on patients' skin in order to protect it and maintain healthy skin during the pretest, while this percentage increased in posttest to be (81.3%) always doing it, and (4.2%) some time respectively. Despite the good knowledge of nurses about area for having more attention while performing skin care, (72.9%) of the study group never paid more attention to pressure points during cleaning the soil or maceration. This result is probably due to lack of supervision and teaching rounds or the senior nursing staff model. The change was statistically significant as p value < 0.05. Also the study found that most of study group (79.2%) never observed proteins and calories in bedridden patient diet, before the interventional program. This result is probably due to the absence of a special diet program for the in-patients in the hospital except for coronary care unit patients. The change was statistically significant as p value < 0.05. This result of the study is consistent with Lioyd-Jones, M.Young, T. Liptrot, P. (2003) study on improving pressure ulcer care through designing educational program. In 2001, a tissue viability audit was undertaken in an acute district general hospital. The audit highlighted deficiencies in the knowledge base of the staff and in the care given to prevent and manage pressure ulceration. As a result, the tissue viability nurse, head of nursing and lecturer identified educational and service needs and developed a special educational program. Pre and Post-course questionnaires are used to assess students' theoretical knowledge. The positive outcome of the program was increase in nurses' knowledge of pressure ulcer prevention and management.[170]

Furthermore, the study showed that there is improvement in nurses performance regarding avoidance of dragging the patients during repositioning, as there are (62.5%) of the study group never avoid it in pre intervention phase, while (72.9%) of the study group always avoided it after

conduction of interventional program with statistically significant p value < 0.05. Regarding the use of special mattress to prevent pressure loadings, the present study shows that there was improvement in participant's performance, after intervention as only (28.1%) of the study group always used a special mattress to prevent pressure loading in pre program results, in contrast to (64.6%) After interventional training program with statistically significant test (P=0.000).

Concerning the participants practice regarding doing back massage to the patient to prevent pressure ulcer formation, this study found that there was no any one of them used to do back massage to the patient (0.00%) pre interventionally. The post intervention result showed an improvement in nursing performance as (29.2%)of the study group always did it, with statistically significant test (P value < 0.05). This poor performance probably is due to shortage of nursing staff and work over load. This result is supported by Peeters Duimel et al (1991 and 2003) study conducted on massage to prevent pressure ulcers. A cross sectional comparative study was designed using written questionnaires regarding knowledge and beliefs about preventive methods and actual use of these methods in the prevention of pressure ulcers. Samples selected via random method. The results as compared with the 1991 findings, the 2003 results showed an improvement in the topic of pressure ulcer but the guidelines of massage was still not widely distributed as it should be.[171]

There was a great difference and variation between participants practice regarding turning the patient position every two hour, despite the good knowledge of nurses about it, in pre intervention checking, only (28.1%) of study group always did it and (36.5%) sometimes did it. This percentage increased to (69.8%) always doing it after interventional training program with statistically significant value (p value < 0.05). This result is probably due to lack of supervision and leadership.

Regarding giving advice to the patient or caregiver regarding pressure ulcer preventive care before discharge, the present study showed that there was improvement in participants performance after intervention as only (24.0%) of the study group always gave advice to the patient or caregiver regarding pressure ulcer prevention care before discharge in pre program results, compared to (64.6%) after interventional training program with statistically significant value (p value < 0.05). In spite of the fact that nursing documentation is a vital component of safe, ethical, effective nursing practice and facilitate communication, the present study showsed that there was no any participant documenting patients data related to pressure ulcer assessment, during pre intervention testing. This percentage increased to (47.9%) post - interventionally, with statistically significant value (p value < 0.05). this result supported by Darmer, MR. and et al (2006) conducted study to determine the Nursing documentation audit- effect of a VIPS implementation program in Denmark.(VIPS is an acronym for well being, integrity, prevention and safety) The study revealed that structured implementation programme significantly improved nursing documentation, and the simultaneous training of the entire nursing staff shows promise. The VIPS model has prepared the nurses for more complex computerized taxonomies and classification systems in the future by improving the nurses' analytical skills. Relevance to clinical practice. New strategies for improving nursing documentation have been demonstrated..[172]

5.2. *Conclusion*

1. Majority of the nurses (78.1%) aged between 22 and 30 years, (87.5%) were female more than half of them were single (54.2%), (75.0%) of them have Bachelor of nursing, (25.0%) have master and none of them had attended any in-service education program.
2. The majority of study group lacked sufficient knowledge regarding pressure ulcer and displayed poor practice regarding pressure ulcer prevention before interventional program and this had been reflected in their inability to perform appropriate nursing -care to the patient.
3. Structured teaching program was found to be effective in providing information and improving the knowledge, skill and participants performance regarding pressure ulcer prevention.
4. Structured teaching programs for in-services nurses regarding pressure ulcer prevention can decrease the incidence of pressure ulcer and it's complications by improving the nurse's knowledge and practice.

5.3. Recommendation:

The following recommendations were derived from the result of this study to reduce the incidence of pressure ulcer and improve its outcome

1. In-service regular training and refresher courses about pressure ulcer prevention for nurses should be designed and conducted regularly.
2. Development of pressure ulcer protocol which should be well communicated employed and monitored.
3. Conduction of regular studies about incidence and causes of pressure ulcer in the hospital.
4. The results of this study should be shared with stake holders such as ministry of health, nurse administrators, nurse teachers, nurse researchers, nurse clinicians and hospital administrators.
5. Modern and state art equipment in the prevention of pressure ulcers should be made available by the hospital to facilitate easy accessibility to it and improve quality of pressure ulcers prevention measures.

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6.2. Questionnaire

University of shendi

Faculty of graduate studies

(Program for nurses on nursing knowledge and practice regarding pressure ulcer and its prevention, at Al- makNimer university hospital., in Shendi city, river Nile state, Sudan

Prepared by: Hawa Ibrahim AbdAlla Hamid.

Supervised by: DrMasaud Isaac Alkhalifa

Subject No……..

Introduction: This questionnaire is divided into 3 sections. Section 1 is related to characteristics of study population . Section 2 is knowledge of the study population regarding pressure ulcer and its prevention. Section 3 is about study population performace regarding pressure ulcer prevention.

Section 1: characteristics of study population:

Instruction: Please tick mark (✓) on your answer in the bracket as indicated.

1. Age :
   a. 22 < 26 Years ( ) b. 26 < 30 Years ( )
   c. 30 < 35 Years ( ) d. ≥ 35 ( )
2. Gender:
   a. Female ( ) b. Male ( )
3. Marital Status:
   a. Single ( ) b. Married ( )
   c. Divorced / divorce ( ) d. Widow / widower ( )
4. Academic qualification:
   a. Bachelor of nursing ( ) b. Master ( )
   c. doctoral of nursing ( )
5. Years of Experience:
   a. Less than 2 years. ( ) b.2 < 6 years. ( )
   c. 6 < 10 years. ( ) d. ≥ 10. ( )

6. Attendance of any training course on pressure ulcer prevention since your graduation as a nurse:

   a. Yes ( ) b. No ( )

7. Place of training course attendance:

   a. Shendi university ( ) b. Other university. ( ) c. Out site Sudan. ( )

8. Department of working :

   a. Medicine. ( ) b. Surgery ( ) c. Intensive care unit. ( )

   d. Coronary care unit( ) e. Obstetrics and Gynecology. ( )

   f. Pediatric( ) g. Nursery. ( ) h. Chemotherapy. ( )

Section 2. knowledge of the study population regarding pressure ulcer and its prevention:

Every question has alternative responses. Select the correct answer among the options and place a tick (✓) mark in the appropriate bracket provided to each statement.

1. The definition of pressure sore is:

   a. Localized injury caused by unrelieved pressure. ( )

   b. Damage of skin. ( )

   c. Inadequate blood supply. ( )

   d. Necrosis. ( )

2. Other nomenclature for pressure ulcer:

   a. Skin tear. ( ) b. Break in the tissue. ( )

   c. Decubitus ulcer. ( ) d. Lesion. ( )

3. The main causes of pressure ulceris:

   a. Advance age. ( ) b. impaired blood circulation.( )

   c. pressure. ( ) d. Unconsciousness. ( )

4. The commonest age for developing pressure sore is:

   a. Adult hood. ( ) b. Middle age. ( )

   c. Old age. ( ) d. Elderly. ( )

5. Clients with urinary or fecal incontinence develop pressure sore due to:

a. Unrelieved pressure. ( ) b. Moisture. ( )

c. Friction. ( ) d. Bacterial infection. ( )

6. Client under shearing force develop pressure sore due to:

a. Friction and gravity. ( ) b. Pressure and gravity. ( )

c. Moisture and pressure. ( ) d. Friction and pressure. ( )

7. Development of pressure sores from wrong method of using bed pan occurs due to:

a. Moisture. ( ) b. Gravity. ( )

c. Shearing force. ( ) d. Friction ( )

8. The point of highest pressure when the client is in Lateral position:

a. Greatertrochanter and hip. ( )

b. Ears and back of scapula. ( )

c. Abdomen and thigh. ( )

d. Elbows and heels. ( )

9. The point of highest pressure in supine position is:

a. Nape of neck. ( ) b. Elbows. ( )

c. Thigh. ( ) d. Sacral region.( )

10. The point of highest pressure In a sitting position is:

a. Shoulders. ( ) b. Back. ( )

c. Buttocks. ( ) d. Sole. ( )

11. The first sign for pressure ulcer development is:

a. Open sore. ( ) b. Burning sensation.( )

c. Blister and bluish discoloration in the skin.( )d. Redness. ( )

12. The following are symptom of stage III pressure ulcer:

a. Open ulcer with a red pink wound bed. ( )

b. Subcutaneous fat may be visible. ( )

c. Bone and tendon are exposed. ( )

d. Shiny or dry shallow ulcer without slough or bruising.( )

13. The symptom of unstageable/ Unclassified category of pressure ulcer is:

a. Open ulcer. ( )

b. Partial thickening. ( )

c. Actual depth of the ulcer is obscured byeschardepth cannot be determined. ( )

d. Deep tissue injury. ( )

14. The appropriate ways for assessment for high risk pressure ulcer development is:

a. Risk assessment scale. ( )

b. Clinical judgment. ( )

c. Physician's order. ( )

d. Laboratory test. ( )

15. The appropriate scale for pressure ulcer risk assessment is:

a. Head to toe scale. ( ) b. Braden scale. ( )

c. Glasgow coma scale. ( ) d. Role of nines scale. ( )

16. Frequency of skin assessment is:

a. Daily. ( ) b. Every two days. ( )

c. Every three days. ( ) d. Weekly. ( )

17. Area for having more attention, while performing skin assessment is:

a. Bony prominence. ( ) b. Skin folds. ( )

c. The back. ( ) d. Skin over flesh. ( )

18. Vitamins needed to maintain healthy skin are:

a. Vitamin D. ( ) b. Vitamin C &E. ( )

c. Vitamin K. ( ) d. Vitamin B. ( )

19. The nutrients needed to prevent bed sore in an elderly patients:

a. High fats. ( ) b. High protein and high calorie. ( )

c. High fiber diet. ( ) d. High fats and high fiber. ( )

20. Frequency of cleaning skin of a client with urinary or fecal incontinences:

a. Every half an hour. ( )

b. Once in two hours at regular interval. ( )

c. Once in four hours at regular interval. ( )

d. During time of soiling and at regular interval. ( )

21. The agent used for the skin cleaning is

a. Herbal soap. ( ) b. Cream based soap. ( )

c. Antiseptic lotion. ( ) d. Mild detergent. ( )

22. The frequency of changing position of a client confined to bed is once in:

a. Every two hours. ( ) b. Every three hours. ( )

c. Every four hours. ( ) d. Every six hours. ( )

23. The frequency of changing position of a client confined to chair is once in:

a. hourly. ( ) b. Every two hours. ( )

c. Every three hours. ( ) d. Every four hours. ( )

24. The main purposes of back care are:

a. Improve circulation. ( ) b. Prevent skin breakdown. ( )

c. Promote soothing effect. ( ) d. All above. ( )

25. The position used for back care is:

a. modified lateral position. ( ) b. flowers position. ( )

c. Prone position. ( ) d. sitting or lateral position. ( )

26. The agent used during massage to reduce friction is applying:

a. Lubricant or lotion. ( ) b. Ointment. ( )

c. Talk powder. ( ) d. Iodine. ( )

27. Pressure relieving devices used to prevent pressure sore are:

a. Air mattress. ( ) b. Cushions. ( )

c. Water mattress. ( ) d. All above. ( )

28. In supine position as a supportive device, pillows should be placed:

a. Under head, hands, arms, lower back and lower legs. ( )

b. Under head, between legs and back. ( )

c. Under head and shoulder and between legs. ( )

d. Under hands, shoulder, back and legs. ( )

29. In lateral position, pillows should be placed:

a. Under head, at the back and between legs. ( )

b. Under head, upper arm, upper legs and at the back. ( )

c. Under upper arm, at the back and between legs. ( )

d. Under head, upper arm, and between legs. ( )

30. An appropriate nursing care for managing mechanical load is:

a. Elevating the head of bed at 30^o. ( )

b. Cleaning soil. ( )

c. Use lubricants and lotions. ( )

d. Turning position. ( )

31. An appropriate nursing activity to reduce friction is:

a. Elevating the head of bed greater than 30^o. ( )

b. Lifting patient without dragging. ( )

c. Placing pressure relieving devices. ( )

d. Elevating the head of bed at 90^o. ( )

32. The nursing care for reducing shearing force is.

a. Elevating the head of bed < 30^o. ( )

b. Elevating the head of bed at 30^o. ( )

c. Elevating the head of bed at 60^o. ( )

d. Elevating the head of bed at 90^o. ( )

33. Exercise prevents pressure ulcer through:

a. Improving blood circulation. ( ) b. Providing energy. ( )

c. Preventing tissue damage. ( ) c. Promoting soothing effect. ( )

34. The most serious complication of pressure sore is:

a. Marjolin ulceration. ( ) b. Blister formation.( )

c. Sepsis. ( ) d. Gas gangrene. ( )

Section3: study population performace regarding pressure ulcer prevention.

Instruction: this section is full by the examiner after observe the nurses at their department practice and tick '✓' the Colum that most closely reflects the nurse practice.

- Never means you do not practice at all.
- Sometimes mean you practice occasionally.
- Always means you practice constantly.

Nurses' practice regarding pressure ulcer prevention	Never	Sometimes	Always
17. The nurse observes how other nurses assess risk factors of pressure ulcer development.			
18. The nurse identifies common contributing factors for pressure ulcer development by periodical assessment of patient's skin.			
19. The nurse does skin assessment that guided by a standard nursing care available in her/his hospital.			
20. The nurse uses risk assessment scale to assess pressure ulcer.			
21. The nurse performs skin care as a routine work of her/his unit.			
22. The nurse places the pillow under the patient's leg to prevent heel ulcer.			
23. The nurse advices caregiver to use creams or oils on patients' skin in order to protect from urine, stool or wound drainage.			
24. The nurse pays more attention to pressure points during cleansing the soil or			

maceration. 25. The nurse observes protein and calories in the bedridden diet 26. The nurse avoids dragging the patients during repositioning. 27. The nurse uses special mattress to prevent the pressure loading 28. The nurse do back massage to the patient's to prevent pressure ulcer formation. 29. The nurse uses donut-shape (ring) cushion at bony prominences to prevent pressure ulcer formation. 30. The nurse turns a patient position every two hour. 31. The nurse gives advice to the patient or caregiver regarding pressure ulcer preventive care before discharge the patient from a hospital. 32. The nurse documents all data related to pressure ulcer assessment.			

6.3. Key answer for Section 2. Nurses' Knowledge about Pressure Ulcer Prevention.

NO. of question	Key answer
1.	A
2.	C
3.	C
4.	D
5.	B
6.	D
7.	C
8.	A
9.	D
10.	C
11.	B
12.	B
13.	C
14.	A
15.	B
16.	A
17.	A
18.	B
19.	B
20.	D
21.	D
22.	A
23.	A
24.	D
25.	D

26.	A
27.	D
28.	A
29.	B
30.	D
31.	B
32.	B
33.	A
34.	C

6.4. consent form Letter to the participants requesting to give consent to participate in the study, and consent form:

Dear Participant:

I am a student of post-graduate nursing program at at Almek Nimir university hospital in Shendi city, river Nile state, Sudan. My program completed by research on " impact of structured teaching program for nurses knowledge and practice regarding to pressure ulcer prevention for hospitalized patient at Almek Nimir Hospital." I would like to give you some questions regarding pressure sore. The information given by you will be used for research purpose only and will be kept confidential. The successful completion of the study largely depends on your active co-operation and participation.

Thanking you

Hawa Ibrahim Abdalla

Consent form:

I here with give, consent for the above said study knowing that all the information provided by me will be treated with utmost confidentiality by the investigator.

Subject's Name (print)_____ Date:_____

Subject's Signature:_____

Investigator's

Signature_____Date:_____