NEAR EAST UNIVERSITY
INSTITUTE OF GRADUATE STUDIES
DEPARTMENT OF NURSING

THE EFFECTIVENESS OF MOBILE APPLICATION IN IMPROVING NURSING STUDENTS' KNOWLEDGE RELATED TO PRESSURE INJURY PREVENTION

PhD THESIS

MO'ATH NAYEF MOHAMMAD ALKHAZALI

Nicosia

June, 2024

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Approval

We certify that we have read the thesis submitted by Mo'ath Nayef Mohammad Alkhazali titled "**The Effectiveness of Mobile Application in Improving Nursing Students' Knowledge Related to Pressure Injury Prevention**" and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Doctorate of Nursing Sciences.

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Declaration of Ethical Principles

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

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Abstract

The Effectiveness of Mobile Application in Improving Nursing Students' Knowledge Related to Pressure Injury Prevention

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Background: Recent developments in intelligent technology have opened up new avenues for innovation in teaching methods, especially within nursing and medical education. The primary aim of the study was comparison of effectiveness of the mobile application and traditional educational methods on attainment of knowledge regarding pressure injury prevention among nursing students. As well, the secondary aim was investigation of the opinions of the nursing students regarding advantages and disadvantages mobile application educational method.

Methods: A randomized controlled study design was implemented during November and December of 2023 in nursing faculty, with 60 students in second nursing level (second year), undergraduate nursing students (30 students in mobile application group and 30 in traditional lecture group). Pressure injury Knowledge Evaluation Form was developed by Beeckman et al. in 2010 used as data collection tool in this study. The study was executed in three stages: pre-test, educational intervention and post-test. The study underwent assessment and approval by the institutional review board (IRB) under the reference number (2023\70\785), following the guidelines outlined in the Helsinki Declaration.

Results: The results of the study during the pre-test showed that there were no statistical significant differences in the mean scores of pressure injury themes between the two groups. However, the post-test scores for all pressure injury themes were higher in the mobile application group compared to the traditional lecture group. The strengths and weaknesses of mobile applications revealed that the majority of students (85%) highlighted the advantages, while 50% acknowledged disadvantage. Lastly, five advantages were highlighted by students: "improvement of students'

knowledge and skills," "boost in self-confidence," "stress reduction," "enhancement of competence," and "stimulation of learning motivation."

Conclusion: the study demonstrates the effectiveness of the mobile application method in enhancing nursing students' knowledge and prophylaxis of pressure injury therefore it is recommended as an innovative and student-centered approach to teaching.

Key Words: phone application, pressure injury, traditional method, nursing students'

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ABBREVIATION

PIs: Pressure Injuries

PU: Pressure Ulcer

SPIPP: Standardized Pressure Injury Prevention Protocol

EPUAP: European Pressure Ulcer Advisory Panel

NPIAP: National Pressure Injury Advisory Panel

PPIA: Pan Pacific Pressure Injury Alliance

SEM: Scanning Electron Microscopy

NPO: Nothing Per Oral

HMB: Hydroxymethylbutyrate

PITA: Australian Pressure Injury Treatment Advisory

COVID 19: Coronavirus Disease 2019

IRBs: Institutional Review Boards

SPSS: Statistical Package for Social Sciences

SD: Standard Deviation

CHAPTER 1

1.**Introduction**

1.1 Background

Pressure Injuries (PIs) represent a global concern and are classified as adverse events in healthcare. There are different data about the prevalence and incidence of PI.Data for hospitalized patients in Europe show a prevalence between 6% and 28.2% (Pérez-López et al,2021; Charalambous et al,2019).

According to a thorough meta-analysis, the point prevalence of pressure ulcers (PUs) worldwide is 14.8% (Al Mutair et al., 2018). Comparably, incidence rates ranging from 6% to 18.5% were found in a comparable study that focused on acute care settings (Tubaishat et al., 2018). Pressure injuries (PIs) are more common in groups that are already at increased risk, such as those with restricted mobility. The good news is that, with the right precautions, these ulcers are largely avoidable. Consequently, it is the duty of healthcare organizations to assist patients throughout their medical journey, provide the best possible care, and minimize unfavorable events (EPUAP/NPIAP/PPPIA, 2019).

A pressure injury (PI) is defined by international guidelines as a localized lesion to the skin and/or underlying tissue. Shear forces combined with pressure can cause this damage, or pressure alone. Although they can also be connected to other items or medical devices, these ulcers typically develop over bony prominences (Lechner et al 2021). According to W.S. Shiferaw et al. (2020), The effects of pressure injuries on social and physical functioning are significant. They can also result in negative psychological effects, financial hardships, and other challenges (H.E. De Laat et al., 2017). Significant inequities are brought about by these injuries, which affect individuals individually as well as healthcare systems. They lengthen hospital stays, increase overall morbidity and death rates, increase the risk of hospital-acquired illnesses, and cause pain and disability (Bail et al, 2018; Ferris et al., 2019).

Extrinsic variables like shear, pressure, and friction, as well as intrinsic factors like advanced age, immobility, and deglutition difficulties, are every element that plays a part in the formation of PI (Schott et al, 2018). The greatest vulnerability to

pressure development People who are confined to beds or wheelchairs due to impaired feeling or mobility are known to have injuries. Moreover, pressure ulcer risk is elevated in older patients in particular due to the aging process' inherent changes to the skin (Joshua et al, 2019).

The visual and tactile identification of different tissues, such as skin, subcutaneous fat, bone, muscle, tendon, and ligament, is necessary for the classification of pressure ulcers. There are four categories in this classification system, plus two more that indicate depth that is not yet known (Fogle 2022; EPUAP/NPIAP/PPPIA, 2019). Stage 1 (least severe, defined by non-blanchable erythema of intact skin) to Stage 4 (most severe, involving full-thickness skin and tissue loss) are the different classifications for pressure injuries. The severity may occasionally be classified as unstageable, and it's crucial to remember that a pressure injury's decline doesn't always proceed in a clear, linear fashion (National Pressure Ulcer Advisory Panel, 2019).

To reduce the likelihood of pressure injuries, a number of preventive measures can be used. Using evidence-based strategies to prevent these ulcers includes tasks like risk assessment, skincare, encouraging physical activity, offering training to staff members, making sure the patient is eating a healthy diet, keeping track of wetness and incontinence, and managing support surfaces (EPUAP/NPIAP/PPPIA, 2019).

Because they are in charge of giving patients the critical care they require, a key role that nurses play in preventing PI. Nurses have specific responsibilities that include identifying patients who are at risk of developing pressure ulcers as part of pressure injury prevention measures (Ebi et al, 2019). In addition to promoting general health, these duties also include activities like repositioning patients, make massages, and applying dressing pads for wounds (Widodo et al, 2017).

With the introduction of cutting-edge technologies that improve learning outcomes and fill in knowledge gaps, the incorporation of technology breakthroughs has significantly transformed healthcare education. A prominent illustration is the mobile application, a flexible medium that has demonstrated potential for successfully distributing instructional content (Smith & Jones, 2022).

This study's objective is to examine how a smartphone application might be used as an additional teaching aid, particularly to increase nursing students'

comprehension of pressure injury avoidance (Johnson & Williams, 2021). Nursing education can better meet the needs of the digital age and improve understanding and application of important concepts like pressure injury avoidance by leveraging mobile technologies (Anderson & Thompson, 2020).

1.2 Statement of problem

Pressure injuries, commonly known as pressure ulcers, bedsores, or decubitus ulcers, are a widespread and troubling issue in various healthcare settings, persistently affecting patients (National Pressure Ulcer Advisory Panel et al., 2019).

Data from 42 studies done in various regions, including Asia, Australia, Europe, the Middle East, North America, and South America, were included in a recent comprehensive analysis (Li et al, 2020). Hospitalized patients sixteen years of age and older were the study's target population. Among 1,366,848 patients, the results showed a combined point prevalence of 12.8% overall. After removing instances classified as Category I, the prevalence dropped to 8%. Based on information from 681,885 patients, the cumulative incidence rate was computed as 5.4% for every 10,000 patient-days.

Pressure injuries continue to pose a major challenge to healthcare systems globally, even with notable progressing in medical understanding and the implementation of comprehensive preventative guidelines (Slawomirski, et al, 2017). Healthcare professionals' lack of knowledge and comprehension of prophylactic measures is one underlying reason that contributes to the endurance of pressure injuries. Among these experts, nurses have essential role for treating and avoiding pressure injuries. They frequently serve as the patients' primary caretakers and are in charge of determining the patients' vulnerability, putting preventive measures into place, and administering the proper wound care (Pancorbo-Hidalgo et al, 2019). Studies, however, show that there are still gaps in nursing practitioners' knowledge and uneven application of best practices (Smith et al, 2022).

The education of nursing students is crucial to the future of healthcare delivery because it shapes their attitudes and competencies as healthcare professionals (SRM IST Chennai,2023). In order to ensure the best possible patient care when they join the work filed, nursing students should establish a solid foundation in pressure injury avoidance during their academic training. Therefore, it's critical to assess how well

educational interventions improve nursing students' understanding of and proficiency with pressure injury prevention (Beeckman et al., 2011).

Interactive Evidence-Based Pressure Injury Education Program for Hospice Nursing was conducted in Cleveland, Ohio in 2022 concluded that frontline hospice nursing staff knowledge and practice improved after attendance at our evidence-based PI education program (Seton et al,2022). Innovative delivery of recurrent EB PI education can enhance learning, retention of knowledge, and increase adherence to best practice recommendations (Carlsson & Gunningberg, 2017). Sahar Dalvand in her study concluded that, the regular training courses and review of PI prevention guidelines can be useful in updating the knowledge of nurses, especially assistant nurses and nursing students on PI prevention (Dalvand et al, 2018).

In order to prepare qualified and self-assured healthcare providers, effective teaching strategies in nursing education are essential. According to recent studies, nursing curricula should incorporate active learning methodologies including problem-based learning, simulation-based training, and flipped classrooms to improve students' critical thinking and clinical decision-making abilities (Cant & Cooper, 2017).

By incorporating contemporary instructional tools, traditional nursing education methods—which frequently involve lectures, readings, and clinical experiences—may be improved. With the addition of multimedia resources, self-paced learning alternatives, and interactive material, mobile applications have become adaptable tools that enhance learning experiences (Hsieh & Cho, 2018).

As mobile technologies have advanced, mobile phones are being used more and more as teaching aids in nursing education (Alsayed et al., 2020). The accessibility of mobile as mobile technologies has advanced, mobile phones are being used more and more as teaching aids in nursing education (Alsayed et al., 2020).

The goal of this study is to determine whether a phone application for pressure injury prevention can close the knowledge gap that exists among nursing students related to pressure injury prevention.

1.3 Significance of the Study

To assure progress in adopting guidelines to direct care and elevate nursing practice standards, this is the first study particularly designed to measure PI knowledge prevention among nursing students in Northern Cyprus using a smartphone application. The results of this study may help develop nursing curricula, customize specific educational programs, and enhance PI management in the clinical setting during clinical placements and future nursing employment—even though the students were enrolled in an educational program and cannot be anticipated to possess the same expertise or understanding as nurses.

The next generation of healthcare workers is represented by nursing students, and their education is a major factor in determining their clinical competency. A dynamic and interesting learning environment can be provided by using cutting-edge educational technologies, such as mobile applications. If proven successful, including these apps could revolutionize the way pressure injury prevention ideas are taught, leading to improved understanding of risk factors, preventative tactics, and wound care procedures.

1.4 Objective of study

The main goal of the study was to evaluate the effectiveness of mobile application on nursing students learn about pressure injury prevention versus traditional methods of teaching. The study's secondary goal was to find out what the nursing students think about the pros and cons of using phone applications as a teaching tool.

1.5 Research hypothesis

The following research hypotheses were established:

1.Nursing students who will complete the phone application PU educational program will have greater general knowledge compared with the traditional learning group.

2.Nursing students who will complete the phone application PU educational program will be more aware of the risk factors, compared with the traditional learning group.

3.Nursing students who will complete the phone application PU educational program will be more aware about prophylaxis regarding PU, compared with the traditional learning group.

4.Nursing students who will complete the phone application PU educational program will have positive opinions.

CHAPTER 2

2.Literiture Review

2.1 Definition and Etiology

According to international standards, "Localized damage to the skin and/or underlying tissue, as a result of pressure or pressure in combination with shear" is the definition of a pressure injury (PI). PIs are sometimes referred to as pressure ulcers (PU), decubitus ulcers, or bedsores. PIs typically develop over a bony prominence, but they can also be connected to an item such as a medical device (Lechner et al 2021; EPUAP/NPIAP/PPPIA, 2019). PIs may appear as an open wound or as intact skin (EPUAP/NPIAP/PPPIA, 2019).

The causes of pressure injuries include intrinsic factors including immobility, age, and swallowing difficulties in addition to extrinsic factors like shear and pressure (Schott et al, 2018). Extended pressure applied to a bony prominence causes necrosis and tissue ischemia. Shear and friction together can affect underlying capillary beds, especially when one is lying on an incline, which can lead to local tissue hypoxia. Furthermore, too much moisture can lead to maceration and deterioration of the skin (Joshua et al, 2019).

Sustained contact with hard surfaces, shearing force, and sustained external pressure are the primary causes of pressure injuries. These factors compress tissue in the bony prominence area, resulting in tissue ischemia at pressure points. Moreover, tissue compression-induced decreased lymphatic drainage can lead to an increase in interstitial fluid and waste accumulation, which in turn can produce pressure injuries (Boyko et al, 2016).

2.2 Incidence and prevalence

PI incidence and prevalence are critical measures of the quality of care, and they range significantly between clinical settings and geographical locations globally (EPUAP/NPIAP/PPPIA, 2019). Comprehending the frequency and occurrence of PIs is crucial to appreciating the magnitude of the issue. Clinicians and healthcare decision-makers can enhance healthcare planning and delivery by making well-informed decisions with this knowledge (Tubaishat et al., 2018).

Studies conducted worldwide in a variety of healthcare environments demonstrate a wide range of pressure injury prevalence, from 0% to 72.5% (EPUAP/NPIAP/PPPIA, 2019). According to a thorough meta-analysis, the global point prevalence of pressure injuries is 14.8% overall (Al Mutairi et al., 2018).

An analysis of a dataset containing 1,893,593 individuals revealed an 8.4% risk of pressure ulcers acquired in hospitals. This prevalence was corrected to 5.1% after category I cases were excluded. The hierarchy of pressure ulcer classifications, as reported in 16 research, was examined and found to be as follows: unstageable wounds with unknown depth (7.8%), presumed deep tissue injuries with unknown depth (2.4%), category I (43.5%), category II (28.0%), category III (12.8%), and category IV (9.9%) (Li z et al., 2020). Remarkably, over half of all pressure ulcers found in adult hospital patients globally were attributed to categories I and II combined. The most commonly impacted region was found to be the sacrum, which was followed by the heels and hips (Li z et al., 2020).

On the other hand, a point prevalence of 14% was reported in the annual Swedish national pressure ulcer (PU) survey carried out in 2021, which included hospitalized patients who were 18 years of age or older (n=8,710). When category was excluded, the prevalence dropped to 8.0% for I PIs. It's important to remember that 11% of PIs were acquired in hospitals (SALAR, 2021).

2.3 Influence on pressure injuries quality of life

The physical and social functioning of individuals is negatively impacted by pressure injuries (Shiferaw et al., 2020). Additionally, they may have a negative psychological impact and cause financial difficulties (De Laat et al., 2017; Furlan, 2017). These injuries have a severe discriminatory impact on patients and the medical community as a whole. They lengthen hospital stays, increase the risk of hospital-acquired infections, produce pain and impairment, and raise rates of morbidity and mortality (Ferris et al, 2019). (Bail et al, 2018).

Even in the best medical institutions, with great nursing care, complications from pressure injuries might still arise. These consequences can arise from pressure injuries at any level, but they are more common in phases III and IV. Cellulitis, osteomyelitis, necrotizing fasciitis, gas gangrene, and septicemia are a few instances of these consequences (Ahmad et al, 2022). Osteomyelitis is a possible consequence of pressure injuries, per a 2019 study by Wong D et al (Wong et al, 2019). Another 2019 study (Dinah et al.) brought attention to the potential for sepsis as a pressure ulcer consequence. Furthermore, in 2021, Hasan Öztin et al.'s study at the Republic of Turkey's Health Sciences University's Erzurum Region Education and Research Hospital found that 13.9% of patients with pressure injuries had bacteremia due to decubitus infections as the causative agent.

Healthcare organizations have a heavy financial burden from pressure injuries (PIs), with costs increasing in proportion to the severity of the ulcers. Increased expenditures are a result of longer healing times and a higher risk of complications in patients with more severe pressure injuries (PIs), especially those in categories III–IV. Care for chronic pressure injuries costs over $22 billion, according to recent data from Medicare beneficiaries (Nussbaum et al., 2018). According to Gerry Bennett et al. (2023), pressure injuries cause more than 2.1 billion pounds in annual costs in the United Kingdom. The yearly economic cost of PI in the US between $9.1 to $11.6 billion. The expenses associated with providing care for a single patient vary from $20,900 to $151,700 per PI. Medicare calculated in 2007 that the cost of a hospital stay increased by $43,180 for every pressure injury (Agency for Healthcare Research and Quality, 2019). The most significant expense related to pressure injuries is nursing time; however, total costs also include supplies for dressing changes, surgery, debridement, medication, lab testing, radiology services, secondary preventive measures, handling complications, emergency visits, and clinic consultations (Demarré et al., 2015; Padula et al., 2019).

2.4 Risk factors of pressure injury

Pressure injuries are characterized by skin sores that typically appear over bony prominences such the elbows, hips, and lower spine. A number of risk factors are associated with these injuries. Those with limited mobility who spend a lot of time in bed are particularly prone to these injuries. These variables include internal elements

like advanced age, immobility, and swallowing problems in addition to exterior ones like shear and pressure (Labeau et al,2021; Schott et al., 2018)

2.4.1 Immobility

People with restricted movement, especially those confined to wheelchairs or beds, are most vulnerable to pressure ulcer development. Furthermore, age-related changes in the skin put older individuals at higher risk (Joshua et al, 2019). Residents with limited mobility are more likely to experience shear and friction, both of which can lead to the development of pressure injuries (Lim et al, 2019).

2.4.2 Loss of sensory perception

PI are more common in people with neurological conditions. or spinal cord injuries that cause diminished sensory perception. A person with complete sensory perception is capable of feeling pain, and they typically become uncomfortable after spending a lot of time in one posture. On the other hand, a person suffering from sensory loss might not experience discomfort or realize that they need adjust their position (Sprigle et al., 2020).

2.4.3 Change in mental status

A person who is experiencing awareness fluctuations might not feel pain or might not be conscious enough to independently change their physical position as needed. According to the results of an Australian study conducted in 2018, the frequency of skin wounds and pressure injuries was linked to cognitive impairment (Brimelow & Wollin, 2018).

2.4.5 Share

Shear is the term used to describe the frictional movement of fat and skin across bones that results from the combined forces of gravity and friction. This usually happens when a patient is lying with their upper body elevated on the bed. Because of this, the spine might move down in the bed, but the skin and fat tissues would stay mostly in place. This impact can cause less evident damage to the skin's surface as well as serious internal tissue damage by damaging underlying blood vessels (Gillespie BM et al., 2020).

2.4.6 Friction

Two surfaces gliding against one another creates friction, which weakens the skin's resistance to pressure and causes abrasions. Shear's effects can be intensified by friction. This could happen if someone moves down on the bed or is moved incorrectly (Angela Morrow, 2023).

2.4.6 Moisture

For those who are wearing diapers to manage incontinence, moisture is a regular concern. Sweat-related dampness might also make the problem worse. Moisture increases the negative effects of shear and friction by reducing the natural skin oils that provide protection and suppleness to connective tissues (Angela Morrow, 2023).

2.4.7 Incontinence

The buildup of skin moisture caused by bowel and urine incontinence makes the skin more vulnerable to tissue deterioration. The risk of infection is increased by stool-borne bacteria and enzymes, which can cause skin damage and contribute to fecal incontinence (Angela Morrow, 2023).

2.4.8 Poor Nutrition

Low nutritional intake can cause weight loss, which puts more strain on the body's bony prominences. It is imperative to maintain adequate diet and hydration, as deficiencies in these areas have a substantial impact on the onset and delayed recovery of pressure injuries (EPUAP, NPIAP & PPPIA, 2019).

2.4.9 Age

Numerous research concentrating on adult populations have found that age is a significant factor that increases the occurrence of pressure injuries. Pressure injuries frequently exhibit a correlation with advanced age. Skin breakdown is more likely as people age since their skin tends to grow thinner and more fragile (Tayyib et al., 2016; Labeau et al., 2021).

2.4.10 Medical conditions

Diabetes, peripheral vascular disease, and cardiovascular disease all impair circulation, making a person more vulnerable to pressure injuries. Furthermore, long surgical operations or protracted stays in intensive care might result in persistent strain on skin tissues (Angela Morrow, 2023).

2.5 Stages of pressure injury

In order to classify pressure injuries, tissue such as skin, subcutaneous fat, bone, muscle, tendon, and ligament must be visually and tactically identified into four distinct categories, plus two categories with undetermined depths (EPUAP/NPIAP/PPPIA, 2019). The severity of pressure injuries is divided into four stages: Stage 1 (lowest severity; non-blanchable erythema on intact skin) to Stage 4 (highest severity; total loss of skin and tissue). The severity of a pressure injury may not always be gradable, and its course is not necessarily straight (National Pressure Ulcer Advisory Panel, 2016).

The American Academy of Family Physicians divided pressure injury into four stages in their most recent edition from 2020 (Robert "Chuck" Rich, 2020):

2.5.1 Stage 1

The sore appears red and may feel warm to the touch during this phase. People may feel a burning feeling, discomfort, or itching. For those with darker skin tones, the pressure sore could seem purple or blue in color.

2.5.2 Stage 2

The area gets more vulnerable as the disease worsens. The sore could turn into an exposed wound that looks like a cut or blister. Around the sore, discoloration may be seen, and pain is probably present.

2.5.3 Stage 3

This stage of the wound results in increasing wound depth and a depression-like look of the sore from deep-seated damage under the surface.

2.5.4 Stage 4

Substantial harm to the skin and tissues occurs, signifying the most severe stage. The sore gets bigger and becomes a deep wound that can get infected. It's possible for joints, muscles, bones, and tendons to show.

2.5.6 Depth unknown

Full thickness tissue loss in which the base of the ulcer is covered by slough and/or eschar in the wound bed (EPUAP/NPIAP/PPPIA,2019).

2.5.7 Suspected deep tissue injury: Depth unknown

Purple or maroon localised area of discoloured intact skin or blood-filled blister because of damage to underlying soft tissue from pressure and/or shear (EPUAP/NPIAP/PPPIA,2019).

2.6 Pressure injury risk assessment instrument

The European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance (EPUAP, NPIAP & PPPIA, 2019) guideline recommends use of structured risk assessment supported by clinical judgement to assess risk. Although around forty PI risk assessment tools are available (Moore & Patton, 2019), none are considered 'gold standard' (Hultin et al., 2022; Moore & Patton, 2019). There is a paucity of quality evidence attesting the efficacy of structured PI risk assessment tools compared to nurses' use of clinical judgement, further limiting clarity as to which method of risk assessment is most effective (Lovegrove et al., 2023). A recent systematic review of the diagnostic accuracy of PI risk assessment scales within ICU, reported the Braden scale as the most frequently used, however the authors concluded that it was not the best tool for this setting (Zhang et al., 2021). Originally, it was developed for use in long-term care settings and subsequent testing in a diversity of settings and multiple countries demonstrates connecting results in validity and reliability (Huang et al., 2021; Wei et al., 2020). The Braden Scale uses a methodical process to provide a numerical score that represents the degree of risk in order to evaluate the likelihood of pressure injuries. In order to revaluate the risk and determine whether patient placement has to be adjusted, this score can be computed after consecutive evaluations (DeniseRichlen, 2020).

The instrument comprises six discrete subscales that contribute to the total score: sensation, activity, mobility, moisture, nutrition, and friction/shear. Every subscale focuses on a particular element that could raise the chance of getting pressure injuries. Sensation assesses how responsively a patient is to pain. While mobility measures the patient's ability to change postures, activity evaluates the patient's physical capacities. Moisture measures how much moisture is exposed to the skin. Nutrition evaluates how many calories a person consumes. The concept of friction/shear relates to a patient's motor control; patients who have poor motor control are more likely to encounter large friction and shear forces during mobilization (Miller et al., 2020).

Braden A slight risk is indicated by a scale score between 15 and 18, but a moderate risk is indicated by a score between 13 and 14. A high risk is indicated by a score between 10 and 12, while a severe danger is indicated by a score less than 9 (Denise Richlen, 2020).

2.7 Pressure Injury Preventions

Preventing pressure injuries is crucial, and the best approach is to prevent their occurrence altogether. Success in this endeavour serves as an indicator of the quality of care (Pittman J et al., 2019). While it may not be possible to prevent all injuries, the majority are preventable with appropriate measures (Lovegrove et al, 2021).

There are several preventive actions that can be taken to decrease the likelihood of pressure injuries. Evidence-based practices for preventing pressure injuries include risk assessment, skincare, promoting activity, providing in-service training, ensuring proper nutrition, managing wetness/incontinence, and optimizing support surfaces (EPUAP/NPIAP/PPPIA, 2019).

The Second Standardized Pressure Injury Prevention Protocol, or "SPIPP" (pronounced S-PIP), was unveiled by the National Pressure Injury Advisory Panel. This protocol, which is based on the 2019 Guidelines on pressure injury prevention, is a streamlined list of preventive measures that can be used at the bedside. The need to create a simplified, evidence-based operational approach to prevention arose from the expansion of the EPUAP-NPIAP-PPPIA guideline (National Pressure Injury Advisory Panel, 2023).

Standardized Pressure Injury Prevention Protocol Checklist (SPIPP- Adult)

ITEM

Assess risk factors for pressure injury to guide risk-based prevention
1. Significant mobility issues, either present or predicted 2. Utilize a systematic approach to risk assessment upon admission (such as Braden or another proven risk instrument). 3. Reevaluate the risk per shift and any materially altered conditions. 4. Patient and family are aware of the prevention plan and PI risk. 5. Other risk factors taken into account: prior PI, localized pain, diabetes, and poor 6. Vasopressors, elevated temperature, oxygenation deficiencies, advanced age, spinal cord damage, neuropathy, duration of surgery or operation > 2 hours. Sedation, mechanical ventilation, organ failure, critical sickness, and medical gadgets
Assess skin/tissue for signs of skin damage and pressure injury
1. Examine the skin thoroughly, visually, and by palpation when the patient is admitted, and check for erythema. discoloration, edema, and temperature 2. Examine the skin while using medical instruments. 3. Examine the heels per shift 4. For those of color, make sure there is enough lighting and moisturize the skin to improve vision 5. Examine improved techniques for evaluating skin, such as thermography, SEM, and skin color charts.
Preventative Skin Care- Manage moisture/Incontinence
1. Immediately following each incidence of incontinence, clean the area and apply the proper moisture barriers. 2. Steer clear of alkaline cleaners and soaps. 3. Take into account fecal and urine management systems for high-risk individuals. 4. High absorbency, single-layer, breathable pads for incontinence 5. Examine utilizing textiles with less friction.

6.When necessary, wicking material to the folds of your skin.

Redistribute Pressure

1.Unless it is contraindicated, turn or reposition people who do not have independent bed movement every two to three hours as needed to meet their specific needs and minimize risk (Braden Activity/movement score of 1 or 2).

2.For individuals who are immobile (Braden Activity/Mobility score of 1 or 2), Use a reactive air mattress or reactive foam mattress with high specifications.

3.Make use of positioning tools (wedges, cushions) that reduce shear and friction. If available, use turn/lift equipment.

4.Maintain as level a head as you can in bed

5.Apply silicone multilayer foam dressings (Braden Activity/Mobility ratings 1-2) to high-risk locations, such as the sacrum, lower buttocks, or heels.

6.Use boots, cushions, or heel devices to raise heels off the bed (Braden Sensory Perception score: 1-3).

7.When side lying, provide proper repositioning (30 degrees).

8.When unstable, use frequent, little, slow, and progressive body adjustments.

9.For those who are unable to properly move themselves, use a pressure-redistributing seat cushion.

10.Adjust sitting individuals within one hour.

11.When necessary, get physical therapy advice for a mobilization program (Braden Activity/Mobility).

12.Take into account motion sensors, pressure mapping, and reminder systems.

13.Establish an early mobilization initiative

Nutrition

1. Check for malnutrition at admission using a validated technique

2. If a person has stage 2 or higher PI (Braden Nutrition Score 1-2), is undernourished, has reduced nutrient intake, or has been non-promoted for more than 48 hours, consult a dietician.

3. Give extra calories, protein, water, and nutrients (such as multivitamins, arginine, glutamine, and HMB) in accordance with the nutrition plan of care or as needed.

4. Keep tracking your progress and seek advice from a dietician as needed.

2.8 Nursing Roles

While the prevention of pressure injuries is a shared responsibility among all healthcare professionals, those directly involved in patient care, particularly nurses, bear a greater burden in administering preventative care (Shrestha et al., 2016). The nurses have a kay role in preventing PI as part of their nursing care for patients. Their roles in PI prevention include assessing Individuals who could sustain PI (Ebi et al., 2019), carrying out duties like treating wounds, massaging, and repositioning, and promoting overall health (Widodo et al., 2017).

Averi Melcher in 2022 summarized the nursing roles in 10 steps :

2.8.1 Look for early signs of PI

The nurse's role in pressure injury prevention also involves monitoring the patient for early signs. This includes observing areas with different texture or temperature compared to the surrounding skin, as well as identifying red patches in patients with pale skin and purple or blue patches in patients with darker skin tones.

2.8.2 Educate patients and their families

Encouraging patients to communicate if they experience pain or itchiness due to their position is essential. If the patient has difficulty speaking up, educating their family on what signs to look for and encouraging them to share any concerns can be beneficial. Involving patients and their families in their care not only helps prevent pressure injuries but also leads to improved health outcomes, quality of life, and satisfaction rates.

2.8.3 Move patients frequently

The general recommendation to reposition patients every two hours lacks scientific evidence to support its effectiveness. Therefore, it's best to approach repositioning on a case-by-case basis. This individualized approach ensures that patients receive appropriate care without unnecessary additional workload for medical staff or disruption of the patient's rest.

2.8.4 Follow safe movement standards to decrease friction

The nurse's role in pressure ulcer prevention involves facilitating movement, but it's essential to prioritize safety. Never attempt to move a patient alone; always follow safe patient handling guidelines to prevent harm to both the caregiver and the

patient. These guidelines include: seeking assistance when moving a patient, utilizing available assistive technology, and obtaining the patient's cooperation before initiating any transfer.

2.8.5 Prevent irritants

Part of the nurse's role in pressure injury prevention involves recognizing that the cleanliness of bedclothes and medical devices can contribute to the formation of pressure injuries.

2.8.6 Keep the patient clean and dry

Friction is a significant contributor to pressure injuries, but moisture also plays a crucial role. Existing literature indicates a strong correlation between high moisture levels and the emergence of PI. The risk of ulcer formation and infection further increases when the patient's skin is exposed to substances like sweat or urine, rather than just water.

2.8.7 Apply barrier creams

Barrier creams can indeed be beneficial in pressure injury prevention in various situations. They help mitigate issues caused by irritants and moisture, thus reducing the likelihood of pressure injuries.

2.8.8 Keep patients hydrated and well-nourished

Keeping patients hydrated and well-nourished is crucial for overall well-being, and this applies to pressure injury prevention as well. Dehydration can interfere with cell metabolism and blood circulation. Since pressure injuries result primarily from inadequate blood flow to the area, Dehydration raises the danger of pressure ulcers developing. Moreover, if pressure injuries do occur, dehydration can significantly impede the recovery process.

2.8.9 Consider collagen for pressure ulcers

One effective supplement for pressure injury prevention is collagen. In the treatment of existing pressure injuries, collagen has been shown to accelerate healing significantly compared to standard care and nutrition. Collagen can be incorporated into a patient's care in two primary ways.

2.9 Treatment

Treatment for pressure injuries must be started as soon as possible in order to enhance healing and reduce the likelihood of consequences (Qaseem et al., 2015). Although everyone may have pressure injuries in comparable ways, each person will

have different main concerns. Consequently, in order to address these issues and provide holistic care, a multidisciplinary team must be included (Jackson et al., 2018). A multidisciplinary approach includes nurses, doctors, nutritionists, allied health professionals, and other members of the care team, according to Qaseem et al. (2015). Furthermore, a wide range of healthcare professionals may provide this treatment in a variety of locations, such as a community, hospital, or residential setting (Qaseem et al, 2015; EPUAP/NPIAP/PPPIA, 2019a).

Reducing pressure on the wound, reducing moisture, and preserving an aseptic or minimally septic environment are the goals of all therapeutic approaches (Zaidi and Sharma, 2022). The injury's stage and the desired outcomes of the treatment—such as lowering moisture, removing necrotic tissue, or managing bacteremia—should be taken into consideration when choosing a course of action (Zaidi and Sharma, 2022). Treatment interventions can include wound care protocols, nutritional support, the use of support surfaces, management of underlying risk factors, adjunctive therapies, and, if required, surgical repair (National Institute for Health and Care Excellence, 2014; Qaseem et al., 2015).

In two weeks, superficial pressure injuries usually start to heal. Nevertheless, there are times when the wound might not heal and even get worse (NPIAP/EPUAP/PPPIA, 2014; Westby et al., 2017; EPUAP/NPIAP/PPPIA, 2019a). The 2019 international guideline (EPUAP/NPIAP/PPPIA, 2019a) states that a thorough re-evaluation of the patient's condition is necessary if a pressure injury does not improve within this period of time despite proper local wound care, pressure redistribution, and nutritional support.

There are many ways to treat pressure injuries, including different types of wound dressings and topical medications including gels, ointments, and creams (Westby et al., 2017). Nevertheless, there is little data to support the effectiveness of particular dressings and topical medications in speeding up the healing of pressure injuries (Westby et al., 2017). The 2019 international guideline (EPUAP/NPIAP/PPPIA, 2019a) states that supplementary therapy should be taken into consideration when chronic osteomyelitis is present or when wounds are not healing adequately. Adjunctive therapies encompass a range of treatments such as

electrotherapy, ultrasound therapy, oxygen therapy, negative pressure wound therapy (NPWT), and surgical wound healing.

Furthermore, the wide range of goods accessible is a barrier for inexperienced practitioners when it comes to PI prevention, assessment, and treatment interventions (Barakat-Johnson et al., 2019a; Li et al., 2022). Depending on the clinician's level of experience, different approaches are taken to treat pressure injuries; less experienced practitioners often turn to experts to assess wounds and provide care advice (Welsh, 2018). Decision-making is further complicated by the fact that these products are not equally distributed or easily accessible in all clinical settings.

In order to effectively treat wounds that are not healing, medical professionals must have a thorough awareness of evidence-based treatments and have access to the right tools. Although prevention and assessment are acknowledged as essential elements of managing pressure injuries, there is a conspicuous lack of explicit and useful guidelines about the treatment of pressure injuries. Practitioners frequently report usability issues or a lack of clear visual aids when referring to the shortcomings of current guidelines (Qaseem et al., 2015; Tachibana et al., 2016; Atkin et al., 2019; EPUAP/NPIAP/PPPIA, 2019a; EPUAP/NPIAP/PPPIA, 2019b; Gefen et al., 2020; Kirman, 2020).

2.10 Nursing Education

Research indicates discrepancies in nurses' knowledge and competencies across various pressure injury (PI) prevention domains, with a tendency for nurses to demonstrate a higher proficiency in recognizing PIs compared to preventing them (Miller et al., 2017; Fulbrook et al., 2019; Oliveira Carvalho et al., 2019; Kim et al., 2019).

Previous research suggests that numerous nurses lack the ability to recognize pressure injury (PI) prevention protocols aimed at alleviating tissue pressure, as well as to classify and assess PI risk (Lavallée et al., 2018; Kim et al., 2019; Oliveira Carvalho et al., 2019). Additionally, studies indicate that nurses possess limited

understanding of PI development and preventive measures (Gunningberg et al., 2015; Miller et al., 2017; De Meyer et al., 2019; Jiang et al., 2020).

Research indicates that nurses who frequently care for patients with pressure injuries (PIs) and who have undergone PI training exhibit better knowledge regarding the prevention and treatment of PIs compared to those who care for patients with PUs less frequently or who have not received any PI prevention training. Furthermore, nurses with higher levels of education or specialization in PIs, such as wound care nurses, demonstrate superior knowledge and skills compared to those with lower levels of education, such as assistant nurses and nursing students, or those who do not work in clinical settings, such as administrative nurses and nurse educators (Aydın et al., 2019; Jiang et al., 2020; Muhammed et al., 2020).

In nursing curricula, various methods are employed to facilitate students' acquisition of theoretical knowledge and practical skills. These methods include lectures, demonstrations, checklists, case scenarios, role-playing exercises, educational videos, and simulated or standardized patient encounters (Mackay et al., 2017; Forehand et al., 2017; Barisone et al., 2019).

2.10.1 Traditional Teaching Methods

Traditional learning, as defined by Neha Joshi (2020), involves a teacher delivering lessons to a group of students in a physical classroom setting. Students attend classes for predetermined durations, learning about specific topics and subjects, often receiving hands-on experience. While technology may be integrated into teaching, the approach typically involves handwritten notes, assignments, and tests. Curriculum adheres to standardized patterns, using government and education board-approved textbooks. Students rely on teachers for subject knowledge acquisition (Neha Joshi,2020).

According to Neha Joshi (2020), traditional teaching methods offer advantages such as facilitating interaction and rapport between teachers and students, fostering moral development, and providing hands-on learning experiences. However, disadvantages include rigid schedules, high infrastructure costs, emphasis on theory over practical activities due to time constraints, and the necessity for both teachers and students to be physically present in the same location. (Neha Joshi,2020).

2.10.2 Mobile Application

Recent developments in intelligent technology have opened up new avenues for innovation in teaching methods, especially within nursing and medical education. Utilizing online platforms, along with interactive learning methods like audience response systems, has proven to be successful in past studies focused on nursing education (Ghasemi, et al, 2020).

Nursing education plays an essential role in preventing PIs. Previous research indicated that nurses possess restricted understanding regarding pressure injury development [Gunningberg et al, 2015]. and preventative measures (Miller et al, 2017; De Meyer et al, 2019; Jiang et al, 2020). Research conducted previously revealed that nurses who regularly care to patients with pressure injuries and those who had training on pressure injury management (Jiang et al, 2020; Aydın et al, 2019; Muhammed et al, 2020), demonstrated enhanced understanding regarding the prevention and treatment of pressure injuries. Consequently, the advancement of novel, engaging, and evidence-based training methods is presently a significant focus within clinical discourse.

Today, with advancements in mobile technologies, mobile phones are increasingly being utilized as educational tools in nursing education (Alsayed, et al, 2020). The availability of mobile Today, with advancements in mobile technologies, mobile phones are increasingly being utilized as educational tools in nursing education (Alsayed, et al, 2020).

The availability of mobile applications enables students to engage in learning, collaboration, and idea-sharing. Consequently, educational institutions must enhance their curriculum practices, emphasizing innovative teaching techniques and approaches as a matter of utmost importance (Toquero, 2020). Research on the integration of mobile applications in nursing education suggests that they contribute to the enhancement of students' knowledge and skills (Cheraghi et al, 2019).

Additionally, the utilization of educational mobile applications has been associated with improvements in students' skills, satisfaction, and overall

competence (Chen, et al, 2021), while also potentially mitigating stress levels among them (Kang, Suh 2018).

Mobile apps enable access to information, offer enjoyable learning experiences, and afford flexibility in terms of time and location for learning (Lall, et al, 2019; Shuja et al, 2019). The using of mobile devices in education underscores a shift from traditional educator-centered teaching to a more learner-centered educational approach (Kakeeto,2021).

The teaching by using the traditional lectures methods typically prioritizes exams performance over the quality of the depth of interactions and participation among students, as well as between students and educators (Al-Hammouria et al, 2020). While the traditional teaching approach remains prevalent in nursing schools, nursing students frequently encounter challenges in effectively grasping nursing content, actively listening, writing, synthesizing information, and translating acquired knowledge into clinical practice (Geist, et al, 2015).

Sobirova, S.U (2021) showed that traditional educational methods, which rely on repetition and memorization, hinder the growth in critical thinking, making choices and solving issues abilities in students (Sobirova, & Karimova 2021). Therefore, it is crucial to devise educational methodologies that evolve in tandem with advancements and address the challenges encountered by undergraduate students.

The number of studies comparing the mobile application teaching method with traditional methods related to nursing students has increased in recent years. These studies results have proven that the group using the mobile application teaching method had greater mean scores compared with traditional lecture methods (Hester,Landon et al, 2020; Sung, et al, 2021; Badiyepeymaiejahromi, Zohreh et al, 2023). Other studies compared mobile applications with traditional lectures have reported that the use of mobile applications played a key role in improving nurses' skills, knowledge, increased confidence and learning attitudes (Choi, et al, 2018; Kim, Park,2019).

In recent studies showed that the effect of using mobile technologies in education. Studies conducted to assess the importance of quality metrics in enhancing the usability of mobile learning systems during the COVID-19 pandemic identified that the key factors influencing learners' satisfaction with mobile learning are service quality, in-formation quality, and system quality (Almaiah et al, 2022(a); Almaiah et al, 2022(b)). A crucial element of mobile-based learning is its capacity to enhance critical thinking skills in students, which in turn promotes self-directed learning (Aurum, & Surjono, 2021).

Ashiq et al. (2023) came to the conclusion in their study that because of the limits of physical libraries and textbooks, traditional learning frequently presents difficulties for students in accessing books and learning resources. On the other hand, students can download e-books, study materials, and videos online via mobile-based learning, which provides easy access to a variety of learning resources through applications and the internet (Ashiq, et al., 2032).

Mobile-based learning is one way to overcome the shortcomings of conventional teaching approaches. According to Tong et al. (2023), this approach to education is more individualized, engaging, and adaptable, making it a good fit for the changing needs of the digital age (Tong, et al, 2023). The study conducted by Farsangi, et al. (2023) revealed that the cultural care training program based on mobile apps had a positive effect on the cultural competence and humility of undergraduate nursing students (Farsangi, et al. (2023). Similarly, Shanmugapriya et al. (2023) concluded that nursing students exhibited positive acceptance and behaviour towards using smartphones (Shanmugapriya et al, 2023).

Despite the number of studies conducted on using mobile application teaching methods in nursing education, more research is warranted to confirm and expand upon these findings.

Introducing innovative strategies for teaching pressure injury topics can enhance nursing students' understanding of pressure injury prevention measures. Assessing the efficacy of a mobile application approach in preventing pressure

injuries could further facilitate the advancement of innovative methods for evidence-based nursing education. The study's main goal was to compare the effect of a mobile application and traditional methods of teaching on nursing students' acquisition of knowledge about pressure injury prevention. As well, the secondary aim was knowing the nursing students` viewpoints related to the advantages and disadvantages of using mobile applications as an educational method. As of now, in Cyprus no studies have been conducted on the integration of mobile applications in nursing education related to pressure injury prevention.

CHAPTER III

3. Materials and Methods

3.1 Study design

The study was implemented using a randomized controlled design

3.2 Study setting

The study was implemented during November and December of 2023 in a faculty of nursing from Northern Cyprus. The curriculum of nursing mainly contains six nursing courses: Pressure Injury (PI) information is primarily covered in the Fundamental course, but it's also referenced in other courses. Typically, conventional methods like PowerPoint lectures and in-class discussions are utilized for educational purposes.

3.3 Selection of sample

The study was composed of 60 students out of 100 second nursing level students (second year), undergraduate English nursing students. The students have finished a fundamental of nursing and medical-surgical nursing as a main course. After the obtain constant students were randomly assigned equally into two groups during the first meeting through the computerized randomization methods by using the Microsoft excel randomized to ensure the homogeneity guaranteed for the both groups the pre-test results were analyzed during randomization. the experimental group and the control group (30 students in each group). The sample size was determined using G-power analysis and based on a previous recent study (Kang H, 2021). Given a level of significance of alpha = 0.05, statistical power level of 0.8, and a medium effect size of ($\eta 2 = 0.06$), the minimum required sample size is 60 in total, with 30 participants in each group being sufficient for a significant MANCOVA analysis.

3.4 Tools of study

2.4.1 Evaluation form of PI knowledge

PU Knowledge Evaluation Form used as data collection tool in this study. The form was developed and validated by Beeckman et al. in 2010. A 26-item instrument was developed, reflecting 6 themes expressing the most relevant aspects of pressure Injury prevention. The content validity was excellent (CVI = 0.78–1.00). The overall internal consistency reliability (Cronbach's A) was 0.77. The 1-week test–retest intraclass correlation coefficient (stability) was 0.88 (D. Beeckman et al. 2010). This evaluation has been used also in previous study was applied in Australia: (Mather, C et,al 2022). Before applying the evaluation form, three specialists in the field of adult health nursing reviewed and approved it. The evaluation form was divided to two section, first section regarding for demographics characteristics of

students and included four questions regarding age, gender, Training department and PI course. The second section consists knowledge assessment of pressure injury and prevention and this section consists of 26 multiple choice items and three alternative responses reflecting 6 themes expressing the most relevant aspects of pressure injury prevention: (1) etiology and development; (2) classification and observation; (3) nutrition; (4) risk assessment; (5) reduction in the magnitude of pressure and shearing; and (6) reduction in the duration of pressure and shearing.

3.*4.2 Students' opinions evaluation form*

After finishing the post-evaluation test, experimental participants group were engaged in face to face interviews. Two open-ended questions regarding the advantage and disadvantage of the phone application approach were consisted in the interview. These questions were formulated as follows: "What are the advantages of utilizing the phone application method?" and "What are the disadvantage associated with the phone application method?"

3.*4.3 Mobile Application*

The mobile application was funded by the researcher and developed by computer and information technology programmers. This application utilizes instructional videos, articles, and brochures to educate users about pressure injuries. The home screen contained 7 icons. The first icon contained a 4-5minute video explaining the Integumentary System. The second contained two short videos: the first one, 1-2 minutes, explained the definition and risk factors of PI, while the second one, 3-4 minutes, explained the causes and development of PI. The third icon contained a 5-6minute video explaining the risk assessment of PI according to the Braden scale. The fourth icon contained a 6-7minute video explaining the stages of PI. The fifth icon contained information on the prevention of PI, and it had two sub-icons: the first one contained a 2-3minute video explaining dressing and treatment of PI, and the second one explained the management of PI. The management icon also contained four sub-icons: the first one contained a 2-3-minute video explaining the general management of PI, the second had a 1-2-minute segment discussing nutrition, the third one had a 3-4minute video talking about repositioning and mobility, and the fourth icon contained a checklist discussing standard PI prevention protocols. The sixth icon contained two icons: the first one had a brief article with title: Pressure

ulcers: Pathophysiology, epidemiology, risk factors, and presentation (Mervis et al,2019), and the second one had a brochure explaining PI prevention. The seventh icon contained contact information for researchers such as phone number, email, and address. The duration of the educational activity ranged between 30-50 minutes. Prior to applying the mobile application, three specialists in the adult health nursing field reviewed its contents and gave their approval.

3.*4.4 Contents of education*

The educational material comprised three sections providing an overview of PI (Pressure Injuries) and the PI prevention concepts:

-First part: Basic knowledge regarding PI and stages

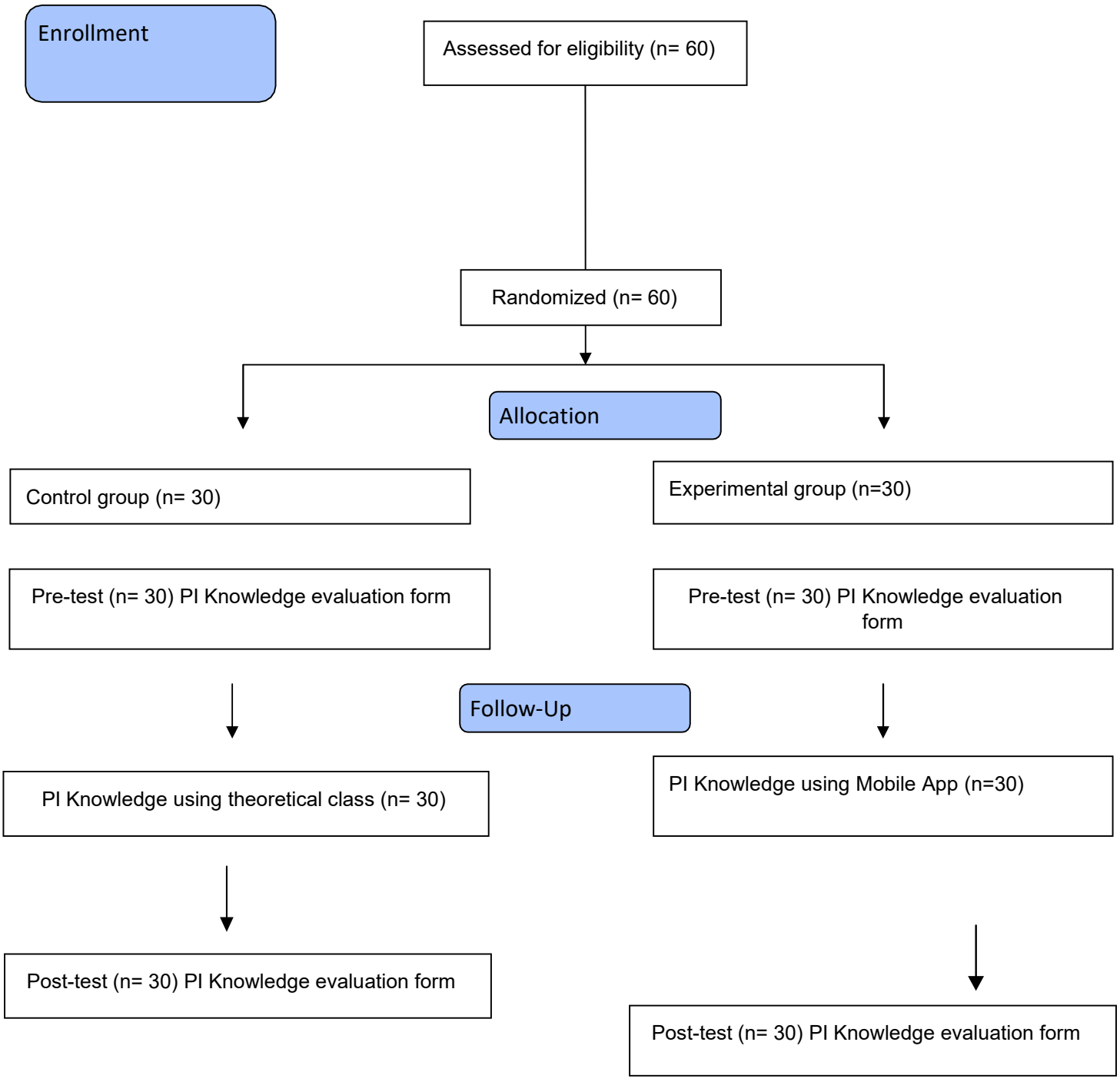
-Second part: Risk factors of PI

-Third part: Evidence-based practices for PI prevention including basic, physical, and pharmacological prophylaxis.

3.*4.5 Implementation*

The study was implemented in November and December of 2023. To promote awareness, posters were used to announce the study, providing information about its purpose. Subsequently, researchers organized a meeting to elucidate the study's objectives and the concept of Mobile application learning. Following this, the study proceeded in three phases: pre-test, educational intervention, and post-test for both groups. The timing of the study was carefully chosen to avoid interfering with the students' midterm and final exams. Furthermore, participants voluntarily enrolled in the study without any form of compensation. They retained the right to withdraw at any point, with the assurance that their grades and future courses would not be affected by the study's outcomes.

Figure 1. *CONSORT Flow Diagram for Study Implementation*


Enrollment
Assessed for eligibility (n= 60)
Randomized (n= 60)
Allocation
Control group (n= 30)
Experimental group (n=30)
Pre-test (n= 30) PI Knowledge evaluation form
Pre-test (n= 30) PI Knowledge evaluation form
Follow-Up
PI Knowledge using theoretical class (n= 30)
PI Knowledge using Mobile App (n=30)
Post-test (n= 30) PI Knowledge evaluation form
Post-test (n= 30) PI Knowledge evaluation form

3.4.6 Experimental group

3.4.6.1 Pre-phase

The pre-evaluation test was held, and all 30 students attended. The second part of Pressure Injury (PI) knowledge evaluation form was used. The exam took place face-to-face in the classroom, lasting one hour.

3.4.6.2 Intra-phase

The students have received an online link to download a mobile application. This application utilizes instructional videos and articles to educate users. The home screen contains icons for each category of Pressure Injury (PI), such as definition and causes, risk factors, risk assessment, stages, management, and prophylaxis. The duration of the educational activity ranged between 30-50 minutes. This phase lasted for two weeks to allow for all students to complete it according to their free time.

3.4.6.3 Post-phase

The post- evaluation test was held two weeks after the intra-phase. The same pre-evaluation test was repeat and the students were asked to completion the second part of the PI knowledge evaluation form once again. Moreover, those in the Mobile application group were asked with responding to two open-ended questions regarding the pros and cons of mobile applications.

3.4.7 Control group

3.4.7.1 Pre-phase

The pre-evaluation test related to the PI knowledge evaluation form was applied in the classroom. The timing, exam and the class were all identical to those in the experimental group, except that they were scheduled on a different day of the week.

3.4.7.2 Intra-phase

The lecturer utilized conventional teaching techniques, which involved using PowerPoint presentations and distributing handing out printed for the topic. In the class conclusion, students were provided with PowerPoints and/or printouts for review outside of class. No additional class activities or interventions were offered. The lecture lasted 2 hours, including time for discussion.

3.4.7.3 Post-phase

The same pre-evaluation test regarding knowledge of Pressure Injuries (PI) was administered again in the classroom.

3.5 Ethics

The study underwent assessment and approval by the Near East University institutional review board (IRB) under the reference number (2023/116-1768), following the guidelines outlined in the Helsinki Declaration. Before the study commenced, in the first meeting from all participating students written informed consent was taken. Students were reassured that their study participation would not affect their grades.

3.6 Statistical analysis

The exam papers were securely collected in a locked locker located within the researcher`s office. SPSS V.28. were used to analyses the data, numeric codes were utilized to input the data. A Kolmogorov–Smirnov normality assessment test was conducted to ascertain whether the data exhibited a normal distribution. Descriptive statistics, including frequencies and percentages, were utilized to analyze participants' characteristics. Parametric statistical tests, specifically independent-sample t-tests, were employed to assess differences between study groups, with a chosen significance level of $p < 0.05$. To calculate the mean, each question was assigned a score of “one” for a correct answer and “zero” for an incorrect answer. Qualitative content analysis and frequency was employed to investigate both the pros and cons of utilizing the mobile application method, where themes pertaining to these aspects were identified.

CHAPTER IV

4.results

Table 1.

Descriptive Characteristics of the Students (N: 60)

Characteristics	**Traditional group**		**Intervention group**		**P value**
	N	**%**	**N**	**%**	
Gender					
Male	21	70	12	40	0.15a
Female	9	30	18	60	
Hospital training department					
Medical	13	43.3	11	36.7	0.13a
Surgical	17	56.7	19	63.3	
Previous PI education					
Yes	28	93.3	23	76.7	0.2b
No	2	6.7	7	23.3	
	Mean		**SD**	**Mean**	**SD**
Age	21.8	1.3	21.1	1.1	0.17c

Abbreviations: PI, Pressure Injury; [a] Fisher's exact test; [b] X_2; [c] The independent sample test

The findings indicated that the mean age of students in the traditional lecture group was 21.8 ± 1.3 years, while in the mobile application (intervention) group, it was 21.1 ± 1.1 years. Nearly all students had previous education in PI. No statistically significant distinctions in descriptive characteristics were observed between the study groups ($p > 0.05$). Consequently, the mobile application and traditional education groups were confirmed to be homogeneous. (Table1)

Table 2.

Comparison of PI Means Score of the Traditional Lecture and the Mobile Application Group

PI Theme	Number of items	Groups	Pre-test Mean score ± SD	Post-test Mean score ± SD	p value (a)
Theme1: Pressure Injury Etiology and Development	5	Traditional lecture	2.4 ± 1.3	3 ± 1.1	0.15
		Mobile application	2.5 ± 1.4	4.1 ± 0.9	<0.001
		p value(b)	0.17	<0.001	
Theme2: Pressure Injury Classification and observation	5	Traditional lecture	2.2 ± 1.2	2.8 ± 1.2	0.11
		Mobile application	2.5 ± 1.3	3.9 ± 0.8	<0.001
		p value(b)	0.12	0.002	
Theme3: Pressure Injury Risk Assessment	2	Traditional lecture	1 ± 0.8	1.2 ± 0.7	0.16
		Mobile application	1.1 ± 0.7	1.5 ± 0.7	<0.001
		p value(b)	0.21	<0.004	
Theme4: Pressure Injuries and nutrition	1	Traditional lecture	0.4 ± 0.5	0.6 ± 0.5	0.17
		Mobile application	0.5 ± 0.5	0.8 ± 0.4	0.013
		p value(b)	0.15	<0.001	
Theme5: Preventative measures to reduce the amount of pressure/shear	7	Traditional lecture	3.5 ± 1.5	4.2 ± 1.4	0.14
		Mobile application	3.8 ± 1.6	5.6 ± 1.3	<0.001
		p value(b)	0.18	<0.001	

Theme6: Preventative measures to reduce the duration of pressure/shear	5	Traditional lecture Mobile application p value(b)	2.7 ± 1.1 3 ± 1.1 0.13	3.1 ± .9 4.2 ± 0.7 <0.003	0.19 .001
Overall	25	Traditional lecture Mobile application p value(b)	12.3 ± 4.5 13.4 ± 4.4 0.24	15.1 ± 3.7 20 ± 3.1 <0.001	0.15 <0.001

Abbreviations: PI, Pressure Injury. [a] Paired *t*-test. [b] The independent sample test

In the pre-test, there was no statistically significant difference observed in the mean scores of PI themes between the mobile application and traditional learning groups. The independent t-test comparing the mean scores of PI themes between the mobile application and traditional learning groups revealed a statistically significant difference. The post-test scores for all PI themes were higher in the mobile application group compared to the traditional lecture group ($p < 0.05$). Additionally, the paired t-test conducted for the mobile application group and traditional group comparing pre- and post-test mean scores, demonstrated that all of the PI themes' scores had improved statistically significantly for both groups ($p < 0.05$). (table2)

Item No	Pressure Injury Etiology and Development theme	Mobile group (N=)		P value *	Traditional group (N=)		P value*
		Pre-test %	Post-test %		Pre-test %	Post-test %	
1.	**Which statement is correct:** A. Malnutrition causes pressure injuries B. A lack of oxygen causes pressure injuries* C. Moisture causes pressure injuries	57.6	94.8	**0.02**	40.3	70.6	0.12
2.	**Extremely thin patients are more at risk of developing a pressure injury than obese patients.** A. The contact area involved is small and thus the amount of pressure higher* B. The pressure is less extensive because the body weight of those patients < obese patients C. The risk of developing a vascular disorder is higher for obese patients and increases risk of PI	33.2	55.2	0.13	37.5	52.1	0.08
3.	**What happens when a patient, sitting in bed in a semi-upright position (60 degrees), slides down?** A. Pressure increases when the skin sticks to the surface B. Friction increases when the skin sticks to the surface C. Shearing increases when the skin sticks to the surface*	53.4	80.7	0.17	44.5	63.8	**0.03**
4.	**Which statement is correct:** A. Soap can dehydrate skin and thus the risk of PI B. Moisture from urine, faeces, or wound drainage causes PI C. Shear is the force which occurs when the body slides and the skin sticks to the surface *	40.7	67.1	**0.04**	34.1	66.3	0.14
5.	**There is NO relationship between pressure injury risk and:** A. Age B. Dehydration C. Hypertension*	50.2	88.1	0.15	46.3	77.3	0.12

Table 3. *Student's Correct Answers Rate Related to Pressure Injury Etiology and Development Theme*

*correct answer, Chi-Square Test

Table 3 shows students' knowledge levels of Pressure Injury etiology and development theme in pre-test and post-test. In the pre-test of the mobile group; "decrease of oxygen lead to PI (57.6%)", "Shearing increases when the skin sticks to the surface (53.4 %)", and "There is NO relationship between pressure injury risk and Hypertension (50.2%)", These items had the highest percentage of right answers. "The contact area involved is small and thus the amount of pressure higher (33.2)" item obtained the least number of correct answers.

In the mobile group in the post-test; "A lack of oxygen causes pressure injuries (94.8%)", "Shearing increases when the skin sticks to the surface (80.7 %)", and "There is NO link between the risk of pressure injuries and high blood pressure. (88.1%)", these items received the highest correct answer rates. In other hand "The contact area involved is small and thus the amount of pressure higher (55.2)" item obtained the least number of correct answers.

Improved performance was statistically significant in the group using mobile applications related to students' knowledge levels of Pressure Injury etiology and development theme in all items particularly "decrease of oxygen lead to PI", "Shearing increases when the skin sticks to the surface" and "There is NO relationship between pressure injury risk and Hypertension" items. (Table 3)

Additionally, there were statistically significant gains in the traditional group related to students' knowledge levels of Pressure Injury etiology and development theme in all items particularly in "decrease of oxygen lead to PI" and "There is NO relationship between pressure injury risk and Hypertension" items. (Table 3)

Table 4. *Students Correct Answer Rate Related to Pressure Injury Classification and Observation Theme*

Item No	Pressure Injury Classification and observation theme	Mobile group (N=)		P value *	Traditional group (N=)		P value*
		Pre-test %	Post-test %		Pre-test %	Post-test %	
1.	**Which statement is correct:** A. A pressure injury extending down to the fascia is a grade 3 PI * B. A pressure injury extending through the underlying fascia is a grade 3 PI C. A grade 3 pressure injury is always preceded by a grade 2 PI	25.3	40.8	0.15	20.5	35.6	0.11
2.	**Which statement is correct:** A. A blister on a patient's heel is always a grade 2 PI B. All grades (1, 2, 3 and 4) of PIs involve loss of skin layers C. When necrosis occurs, it is a grade 3 or grade 4 PI *	32.2	56.1	0.13	38.5	53.1	**0.04**
3.	**Which statement is correct:** A. Friction or shear may occur when moving a patient in bed. * B. A superficial lesion, preceded by non-blanchable erythema is probably a friction lesion C. A kissing ulcer (copy lesion) is caused by pressure and shear	55.8	87.9	0.16	40.6	88.8	0.12
4.	**In a sitting position, pressure injuries are most likely to develop on:** A. Pelvic area, elbow and heel. * B. Knee, ankle and hip. C. Hip, shoulder and heel.	60.7	97.1	0.22	55.1	77.3	0.14
5.	**Which statement is correct:** A. All patients at risk of pressure injuries should have a systematic once a week B. The skin of patients seated in a chair, who cannot move themselves should be inspected every 2–3 h C. The heels of patients who lie on a pressure redistributing surface should be observed at least once a day *	45.2	70.2	**0.03**	46.3	65.4	0.18

*correct answer, Chi-Square Test

Table 4 shows students' knowledge levels of Pressure Injury Classification and observation theme in pre-test and post-test. In the pre-test of the mobile group; "Friction or shear may occur when moving a patient in bed (55.8%)", "The elbow, heel, and pelvic region are the most common places for pressure injuries to occur when seated (60.7%)", These items had the highest percentage of right answers. "A pressure injury extending down to the fascia is a grade 3 PI (25.3%)" item obtained the least number of correct answers.

In the post-test of the mobile group; "Friction or shear may occur when moving a patient in bed (87.9%)", "The elbow, heel, and pelvic region are the most common places for pressure injuries to occur when seated (97.1%)", and These items had the highest percentage of right answers. In other hand "A pressure injury extending down to the fascia is a grade 3 PI (40.8%)" item obtained the least number of correct answers. (Table 4)

Improved performance was statistically significant in the group using mobile applications related to students' knowledge levels of Pressure Injury Classification and observation theme in all items particularly "Friction or shear may occur when moving a patient in bed", "The elbow, heel, and pelvic region are the most common places for pressure injuries to occur when seated" items. (Table 4)

Additionally, there were statistically significant gains in the traditional group related to students' knowledge levels of Pressure Injury Classification and observation theme in all items particularly in "Friction or shear may occur when moving a patient in bed" item. (Table 4)

Item No	Pressure Injury Risk Assessment	Mobile group (N=)		P value *	Traditional group (N=)		P value*
		Pre-test %	Post-test %		Pre-test %	Post-test %	
1.	**Which statement is correct:** A. Risk assessment tools identify all high risk patients in need of prevention B. The use of risk assessment scales reduces the cost of prevention C. A risk assessment scale may not accurately predict the risk of developing new PIs *	53.8	87.6	0.21	45.5	72.6	0.13
2.	**Which statement is correct:** A. The risk of pressure injury development should be assessed daily in all nursing homes B. Absorbing pads should be placed under the patient to minimize risk of PI development C. A patient with a history of pressure injuries runs a higher risk of developing new PIs *	55.9	90.3	0.11	48.7	81.4	**0.02**

Table 5. *Student's Correct Answers Rate Related to Pressure Injury Risk Assessment Theme*

*correct answer, Chi-Square Test

Table 5 shows students' knowledge levels of Pressure Injury Risk Assessment theme in pre-test and post-test. In the pre-test of the mobile group; Both items had nearly identical frequencies of accurate answers. "A risk assessment scale may not accurately predict the risk of developing new PIs (53.8%)", "The risk of getting new pressure injuries is increased in a patient with a history of PIs (55.9%)".

Improved performance was statistically significant in the group using mobile applications related to students' knowledge levels of Pressure Injury Risk Assessment theme in all items "A risk assessment scale may not accurately predict the risk of developing new PIs (87.6%)", "The risk of getting new pressure injuries is increased in a patient with a history of PIs (90.3%)". (Table 5)

There were statistically significant gains in the traditional group related to students' knowledge levels of Pressure Injury Risk Assessment theme in all items particularly in "The risk of getting new pressure injuries is increased in a patient with a history of PIs (81.4%)" item. (Table 5)

Item No	Pressure Injuries and Nutrition	Mobile group (N=)		P value *	Traditional group (N=)		P value*
		Pre-test %	Post-test %		Pre-test %	Post-test %	
1.	**Which statement is correct:** A. Malnutrition causes pressure injuries. B. The use of nutritional supplements can replace expensive preventative measures	32.2	80.1	0.14	26.5	60.2	0.06

Table 6. *Student's Correct Answers Rate Related to Pressure Injuries and Nutrition Theme*

*correct answer, Chi-Square Test

Table 6 shows students' knowledge levels of Pressure Injuries and Nutrition theme in pre-test and post-test. In the pre-test of the mobile group; has a low correct answer rates "Improved general physical health can lower the patient's risk of pressure injuries (PIs) by optimizing nutrition (32.2%)".

There were statistically significant gains in the traditional group and the mobile application groups. related to students' knowledge levels of Pressure Injuries and Nutrition theme item "Improved general physical health can lower the patient's risk of pressure injuries (PIs) by optimizing nutrition (80.1%);(60.2)". (Table 6)

	C. Optimizing nutrition can improve the patient's general physical condition which may reduce risk of PIs *						
Item No	**Pressure Injury Preventative measures to reduce the amount of pressure/shear and observation theme**	**Mobile group (N=)**		**P value ***	**Traditional group (N=)**		**P value***
		Pre-test %	**Post-test %**		**Pre-test %**	**Post-test %**	
1.	**The sitting position with the lowest amount of pressure between the body and the seat is:** A. An upright sitting position, with both feet resting on a footrest B. An upright sitting position, with both feet resting on the floor C. A backwards sitting position, with both legs resting on a footrest	40.7	89.4	0.12	36.5	57.6	0.11
2.	**Which repositioning scheme reduces pressure injury risk the most?** A. Supine position—side 90 degrees lateral position—supine B. Supine position—side 30 degrees lateral position—side 30 * C. Supine position—side 30 degrees lateral position—sitting	52.1	90.2	**0.03**	48.5	73.1	0.09
3.	**Which statement is correct:** A. Friction or shear may occur when moving a patient in bed. * B. A superficial lesion, preceded by non-blanchable erythema is probably a friction lesion C. A kissing ulcer (copy lesion) is caused by pressure and shear	57.3	95.3	0.16	51.6	87.4	0.16
4.	**If a patient is SLIDING down in a chair, the magnitude of pressure at the seat can be reduced the most by:** A. A thick air cushion * B. A donut shaped foam cushion. C. A gel cushion.	35.1	70.8	0.22	33.8	62.3	0.12

Table 7. *Students Correct Answer Rate Related to Pressure Injury Prevention* Measure to R*educe the Amount of Pressure/Shear and bservation theme*

5.	**For a patient at risk of developing a pressure injury, a visco-elastic foam mattress:** A. Reduces the pressure sufficiently and does not need to be combined with repositioning B. Has to be combined with repositioning every 2 h. C. Has to be combined with repositioning every 4 h *	22.2	55.6	**0.02**	27.3	60.4	0.15
6.	**A disadvantage of a water mattress is:** A. Shear at the buttocks increases. B. Pressure at the heels increases. C. Spontaneous small body movements are reduced. *	45.6	73.2	0.12	41.3	63.2	**0.03**
7.	**When a patient is lying on a pressure reducing foam mattress . . .** A. Elevation of the heels is not necessary B. Elevation of the heels is important. * C. He or she should be checked for 'bottoming out' at least twice a day	59.3	90.5	0.25	50.7	89.6	0.1

*correct answer, Chi-Square Test

Table 7 shows students' knowledge levels of Pressure Injury Preventative measures to reduce the amount of pressure/shear and observation theme in pre-test and post-test. In the pre-test of the mobile group; "Supine position—side 30 degrees lateral position—side 30 (52.1%)", "Friction or shear may occur when moving a patient in bed (57.3%)" and "Elevation of the heels is important (59.3%)", The highest percentage of correct answers were given to these items. "Has to be combined with repositioning every 4 h (22.3%)" item had the lowest percentage of accurate responses.

In the post-test of the mobile group; "A backwards sitting position, with both legs resting on a footrest (89.4%)", "Supine position—side 30 degrees lateral position—side 30 (90.2%)", "Friction or shear may occur when moving a patient in bed (95.3%)" and "Elevation of the heels is important (90.5%)", The highest percentage of correct answers were given to these items. In other hand "Has to be combined with repositioning every 4 h (55.6%)" item had the lowest percentage of accurate responses. (Table 7)

Improved performance was statistically significant in the group using mobile applications related to students' knowledge levels of Pressure Injury Preventative measures to reduce the amount of pressure/shear and observation theme in all items particularly "A backwards sitting position, with both legs resting on a footrest", "Supine position—side 30 degrees lateral position—side 30", "Friction or shear may occur when moving a patient in bed" and "Elevation of the heels is important" items. (Table 7)

There were statistically significant gains in the traditional group related to students' knowledge levels of Pressure Injury Preventative measures to reduce the amount of pressure/shear and observation theme in all items particularly in "Friction or shear may occur when moving a patient in bed" and "Elevation of the heels is important" items. (Table 7)

Table 8.

Student's Correct Answers Rate Related to Pressure Injury Preventative Measures to Reduce the Duration of Pressure/Shear

Item No	Preventative measures to reduce the duration of pressure/shear theme	Mobile group (N=)		P value *	Traditional group (N=)		P value*
		Pre-test %	Post-test %		Pre-test %	Post-test %	
1.	**Repositioning is an active preventive measure because . . .** A. The magnitude of pressure and shear will be reduced. B. The amount and the duration of pressure and shear will be reduced C. The duration of pressure and shear will be reduced. *	60.1	97.2	0.11	52.5	90.9	0.06
2.	**Fewer patients will develop a pressure injury if . . .** A. Food supplements are provided. B. The areas at risk are massaged. C. Patients are mobilized. *	45.2	82.3	0.21	40.5	70.2	**0.02**
3.	**Which statement is correct:** A. Patients at risk lying on a non-pressure reducing foam mattress should be repositioned every 2 h * B. Patients at risk lying on an alternating air mattress should be repositioned every 4 h Patients at risk C. lying on a visco-elastic foam mattress should be repositioned every 2 h	58.7	93.3	**0.02**	43.6	77.4	0.17
4.	**When a patient is lying on an alternating pressure air mattress, the prevention of heel pressure injuries includes:** A. No specific preventive measures. B. A pressure reducing cushion under the heels. C. A cushion under the lower legs elevating the heels. *	32.1	69.8	0.22	28.6	60.3	0.11
5.	**If a bedridden patient cannot be repositioned, the most appropriate pressure injury prevention is…** A. A pressure redistributing foam mattress. B. An alternating pressure air mattress. * C. Local treatment of the risk areas with zinc paste	51.2	92	**0.04**	41.3	71.4	0.12

*correct answer, Chi-Square Test

Table 8 shows students' knowledge levels of Pressure Injury Preventative measures to reduce the duration of pressure/shear theme in pre-test and post-test. In the pre-test of the mobile group; "The duration of pressure and shear will be reduced (60.1%)", "Patients at risk lying on a non-pressure reducing foam mattress should be repositioned every 2 h (58.7%)" and "An alternating pressure air mattress (51.2%)", The highest percentage of correct answers were given to these items. "A cushion under the lower legs elevating the heels (32.1%)" item had the lowest percentage of accurate answers.

In the post-test of the mobile group; "The duration of pressure and shear will be reduced (97.2%)", "Patients are mobilized (82.3%)", "Patients at risk lying on a non-pressure reducing foam mattress should be repositioned every 2 h (93.3%)" and "An alternating pressure air mattress (92%)", The highest percentage of correct answers were given to these items. "A cushion under the lower legs elevating the heels (69.8%)" item had the lowest percentage of accurate answers. (Table 8)

Improved performance was statistically significant in the group using mobile applications related to students' knowledge levels of Pressure Injury Preventative measures to reduce the duration of pressure/shear theme in all items. (Table 8)

There were statistically significant gains in the traditional group related to students' knowledge levels of Pressure Injury Preventative measures to reduce the duration of pressure/shear theme in all items particularly in "The duration of pressure and shear will be reduced" and "Patients at risk lying on a non-pressure reducing foam mattress should be repositioned every 2 h" items. (Table 8)

Table 9.
Advantages and Disadvantages of Using Mobile Applications

Advantage	%	Disadvantage	%
Improvement of students' knowledge and skills	90	Time demands	30
Boost in self-confidence	85	Technological requirements	50
Stress reduction	82	Cost implications	70
Enhancement of competence	78		
Stimulation of learning motivation	90		
	85		50

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The strengths and weaknesses of mobile applications revealed that the majority of students (85%) highlighted the advantages, while 50% acknowledged disadvantage (Table 3). Participants' responses identified five categories related to the advantages of mobile applications: "improvement of students' knowledge and skills," "boost in self-confidence," "stress reduction," "enhancement of competence," and "stimulation of learning motivation." On the other hand, the disadvantages of mobile applications were categorized into three groups: "time demands," "technological requirements," and "cost implications."

4.1Advantage of mobile application

Improvement of students' knowledge and skills

The majority of students indicated that using the mobile application was a new and unique experience for them, marking their first encounter with such an innovative teaching method. They reported significant improvements in their knowledge and skills after using the mobile application example:

"The students said that by offering a creative and interesting learning environment, the mobile application improved their knowledge and abilities. They valued the special elements and participatory techniques, which helped them get a better comprehension and set of skills overall."

Stimulation of learning motivation

Students reported that they felt deeply motivated during the course after using the mobile application.

"Mobile applications can push individuals to step out of their comfort zones in a positive way. They encourage learning how to navigate course lectures, download materials, and communicate effectively in a digital environment, which are valuable skills in today's world."

Boost in self-confidence and stress reduction

"Students said that by pushing them to outside their comfort zones, the mobile application increased their confidence. Through the application, they had to pick up skills that are crucial in today's world: navigating course lectures, downloading resources, and effectively communicating in a digital setting. They now feel more confident in their abilities to use digital tools and engage in online learning as a result of this experience"

Enhancement of competence

"The student stated that by offering a thorough and engaging learning experience, the mobile application improved their competency. They had to use the program to obtain documents, participate in digital communication, and navigate course lectures. Through these exercises, they were able to acquire vital abilities that

improved their general competence and self-assurance when using digital tools and online learning environments."

4.2 Disadvantage of mobile application

Cost implications

"The student mentioned that the mobile application's financial ramifications were one drawback. They pointed out that some users would find the charges of downloading and installing the software prohibitive, as well as the possibility of additional fees for in-app purchases or subscriptions. Despite the application's advantages in improving their proficiency and educational experience, this financial component was considered a disadvantage."

Technological requirements

The lack of technological resources was seen as a challenge. Nevertheless, having access to such resources can greatly enhance study efforts and support students in reaching their learning goals.

"There are certain technological requirements that might not be easily accessible. For instance, using mobile data for connectivity can lead to significant expenses if I am taking an online course."

Time demands

Several students expressed concerns about the time requirements, noting that the tasks were strenuous and demanded more effort and time.

"Research demands considerably more time compared to traditional schooling. In a traditional school setting, I typically acquire all necessary information during school hours, which isn't the case with mobile applications."

CHAPTER V

5. Discussion

The aim of this study was to evaluate how the use of a mobile application affects the knowledge and skills of 30 nursing students in relation to pressure injury during their nursing education. Every day, smartphones and other technological devices have become the initial and final points of interaction for humans (Alsayed, et al, 2020). Utilizing technology in education adds an element of enjoyment and excitement to the learning process, spanning various fields, including nursing education (Forehand, J. W et al, 2017). Chuang, S.-T et al, (2022) demonstrated that E-book applications offer individuals the flexibility to manage their learning schedule and environment. Additionally, hands-on observation of procedural skills offers trainees feedback on techniques, enhancing the effectiveness of learning and the quality of pressure injury care (Chuang, et al, 2022).

In this study the main findings revealed no significant statistical variances in the average scores of Pressure Injury (PI) categories between the two cohorts during the initial assessment. However, students instructed through the mobile application method exhibited higher mean scores across all PI categories compared to those taught through traditional methods. This trend persisted in the subsequent assessment, with the mobile application group maintaining higher mean scores in all PI categories compared to the traditional teaching group. These findings substantiate the study's hypothesis that Nursing students undergoing the mobile application PI educational program would possess broader knowledge and heightened awareness of PI risk factors and prevention compared to those in the traditional learning cohort. Thus, demonstrating the efficacy of employing mobile applications as a teaching tool.

Chuang, et al 2022; Hester et al 2021; Lee et al 2019 are recent studies and they showed that using the mobile application teaching method has a positive effects on the improvement of the nursing students (Lee,et al 2019; Hester et al 2021; Chuang,et al, 2022) . the scores showed there is no significant differences statistically between the traditional lecture group and mobile application group in all of PI themes during the pre-test which indicates that basic knowledge is comparable.

On the contrary, the scores showed a significant improvement in all PI themes in the mobile application group, and that is congruity with the study (Kim & Park, 2019). This is also what was reflected in a previous study conducted by Chuang, 2022, which confirms the effectiveness of an E-Book App applications teaching methods in improving nursing students' information and awareness regarding PI prevention and this confirms the validity of the hypothesis that nursing students who use mobile phone applications they will possess a broader comprehension of PI general knowledge and they will also have an increased awareness of the risk factors and methods for preventing pressure injuries (Chuang, 2022).

In our study, the main results on effectiveness of using the mobile application teaching method in enhancing nursing students' knowledge and prevention regarding to PI demonstrated no significant differences in pre-test between the both groups in all PI themes. This indicates that both groups started with a similar level of knowledge regarding pressure injury prevention. However, in the post-test, the group that utilized the mobile application for learning exhibited higher mean scores across all themes compared with the traditional lecture group. These results demonstrate the effective-ness of the mobile application method in educating nursing students about pressure injury prevention and confirm the hypothesis of the study, which posited that " Com-pared to the traditional teaching group, nursing students who use the mobile application for pressure injury prevention education applications they will possess a broader comprehension of PI general knowledge and they will also have an increased aware-ness of the risk factors and preventative measures pertaining to pressure injuries." This also corresponds to Major, et al 2021; Chen, et al 2021 where conclude in their studies that the mobile learning yields positive impact in clinical nursing education for nursing students when compared to traditional methods (Major, et al 2021; Chen,et al 2021).

Recent studies have underscored the significant positive impacts that innovative educational methods, such as mobile applications, have on nursing students' learning outcomes. Our results align with the findings of Ghazanchaei et al. 2019 who found that e-learning significantly improved nurses' knowledge of VTE and Khalid Al-Mugheed et al 2021 who reported that The flipped classroom approach has demon-strated positive outcomes in various domains related to venous thromboembolism (VTE) among nursing students, particularly in terms of

knowledge acquisition, risk assessment, and understanding prophylaxis measures (Ghazanchaei et al. 2019 ; Al-Mugheed , Bayraktar , 2021(a), Al-Mugheed , Bayraktar , 2021(b)). This indicates using the healthcare education by digital learning platforms became more widely and efficient and This confirms the effectiveness of this approach because it focuses on the learner and It provides flexible access to information and activities online, Thus, mobile applications contribute positively to improving students' knowledge and the quality of education (Gause, et al, 2022).

On other hand, the study was conducted in 2021 by Khaled Al-mugeed et al showed that there is no significant improvement statistically in all of mean scores according to traditional lecture group comparing with flipped classroom group (Al-Mugheed, Bayraktar, 2021(a)). These results consistency with our study which showed that there is no significant improvement statistically in all of mean scores according to traditional lecture group comparing with mobile application group.

A randomized experimental study with pre- and post-tests conducted in Taiwan involving 100 nursing students utilized a mobile app for clinical care learning. The results showed that the experimental group had significantly higher knowledge scores and greater satisfaction levels compared to the control group (Chang et al, 2022). In addition, similar findings were observed in a controlled experimental study conducted in Turkey with 122 nursing students. This study indicated that the post-test results of the experimental group, which used an app for injection practices, showed a significant positive effect on knowledge levels ($p<0.05$) (Kurt, Öztürk, 2021). A quasi-experimental study was implemented in Brazil showed that the app was deemed satisfactory and led to a notable increase in nursing students' knowledge, thus proving suitable for its intended purpose (Negreiros et al, 2022). Coelho MMF et al. (2021) concluded that The utilization of the application for therapeutic communication enhanced the knowledge of nursing students compared to the traditional teaching method (Coelho et al, 2021). Other study demonstrated that nursing students utilize mobile devices as an educational tool and found them effective in enhancing their knowledge and acquiring clinical skills (Nikpeyma et al, 2021). Niromand et al (2024) concluded that the Mobile-based learning is emerging as a significant educational approach with pro-found implications for healthcare education and the improvement of patient care quality. The widespread incorporation of mobile phones into the educational frame-work

provides a flexible teaching paradigm, thus nurturing the potential for continuous lifelong learning (Niromand et al, 2024). And all of the findings in these studies compatible with our study findings.

Moreover, the advantage and disadvantage of mobile applications provide the qualitative feedback about implementing the mobile learning applications in nursing education. The identified advantages were included in our study, improvements in knowledge and skills, enhanced self-confidence, and stimulation of learning motivation, highlight the multifaceted benefits of m-learning in nursing education. Conversely, the noted disadvantages—such as time demands, technological requirements, and cost implications—highlight areas for improvement and the need for institutions to provide adequate support and resources to maximize the effectiveness of these tools and this is consistent with the results shown by these studies Chen et al. 2021; Al-Mugheed et al 2021).

5.1 limitations of study

The study has several limitations. Since our study was conducted at a single nursing faculty, its findings cannot be generalized to broader populations or settings. Study focus in knowledge more than the skills on PI prevention and that was considered one of the study limitation. The limited number of included studies prevented the classification of different time points for outcome assessment, which could have influenced the results. The study solely examined the influence of certain aspects of mobile learning on academic performance, perceived satisfaction, and perceived usefulness. Consequently, future research exploring additional characteristics is suggested.

CHAPTER VI

1.1 Conclusion

The present study demonstrates the effectiveness of the mobile application meth-od in enhancing nursing students' knowledge of PI. Compared to traditional lectures, mobile applications emerged as a more credible and efficient teaching tool. Moreover, the study elucidates both the advantages and disadvantages associated with mobile application use. It can be inferred that these findings hold significant implications for nursing education. The mobile application method exhibits considerable potential in preparing students for healthcare environments by fostering knowledge application, flexibility, and critical thinking skills. It is therefore recommended as an innovative and student centred approach to teaching. Additionally, policymakers and educators can utilize these results to formulate strategies aimed at enhancing nursing education. However, further research with larger sample sizes and integration of this method into the nursing curriculum is warranted to fully explore its efficacy.

6.2 Recommendations

1.It is suggested that mobile application teaching methods can be a credible and more effective approach for nursing education compared to traditional lectures.

2. Further studies involving larger samples and assessing the long-term effects of the mobile application method are recommended.

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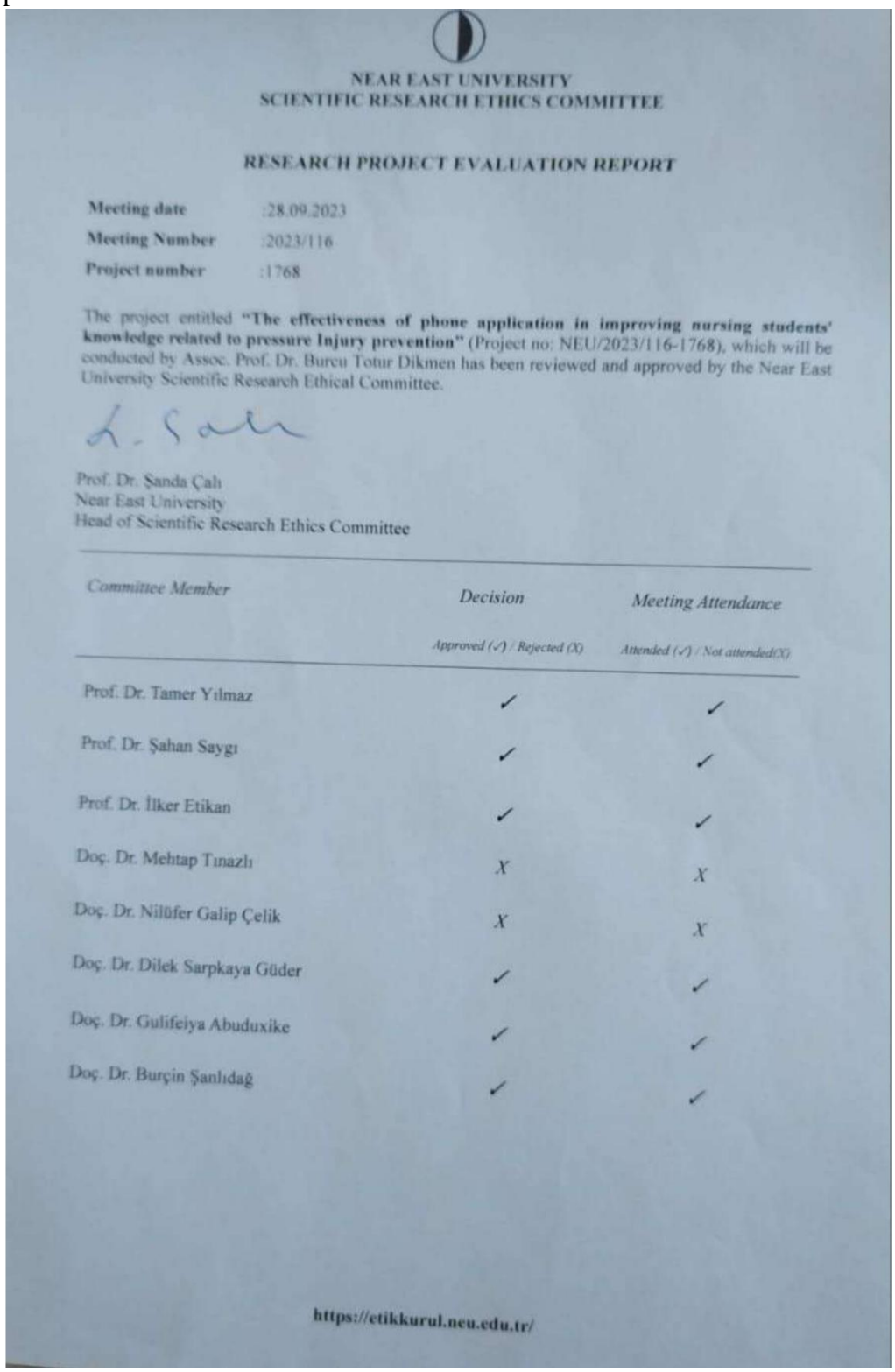
Appendix 1: Near East University Institutional Review Board (IRB) Ethical Approval



NEAR EAST UNIVERSITY
SCIENTIFIC RESEARCH ETHICS COMMITTEE

RESEARCH PROJECT EVALUATION REPORT

Meeting date :28.09.2023
Meeting Number :2023/116
Project number :1768

The project entitled **"The effectiveness of phone application in improving nursing students' knowledge related to pressure Injury prevention"** (Project no: NEU/2023/116-1768), which will be conducted by Assoc. Prof. Dr. Burcu Totur Dikmen has been reviewed and approved by the Near East University Scientific Research Ethical Committee.

Prof. Dr. Şanda Çalı
Near East University
Head of Scientific Research Ethics Committee

Committee Member	*Decision* Approved (✓) / Rejected (X)	*Meeting Attendance* Attended (✓) / Not attended(X)
Prof. Dr. Tamer Yılmaz	✓	✓
Prof. Dr. Şahan Saygı	✓	✓
Prof. Dr. İlker Etikan	✓	✓
Doç. Dr. Mehtap Tınazlı	X	X
Doç. Dr. Nilüfer Galip Çelik	X	X
Doç. Dr. Dilek Sarpkaya Güder	✓	✓
Doç. Dr. Gulifeiya Abuduxike	✓	✓
Doç. Dr. Burçin Şanlıdağ	✓	✓

https://etikkurul.neu.edu.tr/

Appendix 2: Informed Consent Form (Participant Students)

NEAR EAST UNIVERSITY
ETHICS REVIEW BOARD

INFORMED CONSENT FORM

(PARTICIPING STUDENTS)

After Ethical approval will be obtained from Institutional Reviews Board (IRB) of Near East University, the nature of study will be explained to the students and Before starting the study, written informed consent will be obtained from all students.

You are invited to participate in a research study conducted by Assoc. Prof. Dr. BURCU TOTUR DİKMEN and MO'ATH ALKHAZALI, from the Near East University Faculty of Health Sciences, Nursing Department. This study was planned to determine the effectiveness of phone application in improving nursing students' knowledge related to pressure injury prevention. You were selected as a possible participant in this study, because findings of the study may be useful in improving nurses' awareness and preventing this important public health problem. If you decide to participate, a Phone application and pre and post-test will be used as evaluation form tool in this study. The test contains questions regarding for demographics, knowledge and practices of nurses on PI prevention with 3 choices. However, I cannot guarantee that you personally will receive any benefits from this research. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Subject identities will be kept confidential by don't using the name, and using participant coding. Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with your department. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty. If you have any questions about the study, please feel free to contact [05338604682- malkhazali@eul.edu.tr]. [0 5064781233- burcu.toturdikmen@neu.edu.tr]. If you have questions regarding your rights as a research subject, please contact the Near East Institutional Review Board. You will be offered a copy of this form to keep. Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you will receive a copy of this form, and that you are not waiving any legal claims.

Participant
Name, Surname:
Address:
Phone:
Signature:

Witness
Name, Surname:
Address:
Phone:
Signature:

Interviewer:
Name, Surname:
Address:
Phone:

http://etikkurul.neu.edu.tr

Appendix 3: Data Collection Tool

1. Characteristics of Nursing Students Participants Subject Number:		
1. Age		
2. Gender	1□ Male 2□ Female	
3. Training department (practicing wards)	1□ medical 2□ surgical 3□ maternal–child 4□ critical 5□ mental health	
4. Previous PI education	1□ Yes	2□ No

2. knowledge assessment of pressure injury and prevention

Theme 1: pressure injury etiology and development

1-Which statement is correct:

A. Malnutrition causes pressure injuries.
B. A lack of oxygen causes pressure injuries *
C. Moisture causes pressure injuries

2-Extremely thin patients are more at risk of developing a pressure injury than obese patients.

A. The contact area involved is small and thus the amount of pressure higher *
B. The pressure is less extensive because the body weight of those patients < obese patients
C. The risk of developing a vascular disorder is higher for obese patients and increases risk of

3-What happens when a patient, sitting in bed in a semi-upright position (60 degrees), slides down?

A. Pressure increases when the skin sticks to the surface
B. Friction increases when the skin sticks to the surface
C. Shearing increases when the skin sticks to the surface *

4-Which statement is correct:

A. Soap can dehydrate skin and thus the risk of PI
B. Moisture from urine, faeces, or wound drainage causes PI
C. Shear is the force which occurs when the body slides and the skin sticks to the surface *

5-There is NO relationship between pressure injury risk and:

A. Age
B. Dehydration
C. Hypertension*

Theme 2: pressure injury classification and observation

1-Which statement is correct:

A. A pressure injury extending down to the fascia is a grade 3 PI *
B. A pressure injury extending through the underlying fascia is a grade 3 PI
C. A grade 3 pressure injury is always preceded by a grade 2 PI

2-Which statement is correct:

A. A blister on a patient's heel is always a grade 2 PI
B. All grades (1, 2, 3 and 4) of PIs involve loss of skin layers
C. When necrosis occurs, it is a grade 3 or grade 4 PI *

3-Which statement is correct:

A. Friction or shear may occur when moving a patient in bed. *
B. A superficial lesion, preceded by non-blanchable erythema is probably a friction lesion
C. A kissing ulcer (copy lesion) is caused by pressure and shear

4-In a sitting position, pressure injuries are most likely to develop on:

A. Pelvic area, elbow and heel. *
B. Knee, ankle and hip.
C. Hip, shoulder and heel.

5-Which statement is correct:

A. All patients at risk of pressure injuries should have a systematic once a week
B. The skin of patients seated in a chair, who cannot move themselves should be inspected every 2–3 h
C. The heels of patients who lie on a pressure redistributing surface should be observed at least once a day *

Theme 3: pressure injury risk assessment

1-Which statement is correct:

A. Risk assessment tools identify all high risk patients in need of prevention
B. The use of risk assessment scales reduces the cost of prevention
C. A risk assessment scale may not accurately predict the risk of developing new PIs *

2-Which statement is correct:

A. The risk of pressure injury development should be assessed daily in all nursing homes
B. Absorbing pads should be placed under the patient to minimize risk of PI development
C. A patient with a history of pressure injuries runs a higher risk of developing new PIs *

Theme 4: pressure injuries and nutrition

1-Which statement is correct:

A. Malnutrition causes pressure injuries.
B. The use of nutritional supplements can replace expensive preventative measures
C. Optimizing nutrition can improve the patient's general physical condition which may reduce risk of PIs *

Theme 5: preventative measures to reduce the amount of pressure/shear

1-The sitting position with the lowest amount of pressure between the body and the seat is:

A. An upright sitting position, with both feet resting on a footrest
B. An upright sitting position, with both feet resting on the floor
C. A backwards sitting position, with both legs resting on a footrest *

2-Which repositioning scheme reduces pressure injury risk the most?

A. Supine position—side 90 degrees lateral position—supine
B. Supine position—side 30 degrees lateral position—side 30 *
C. Supine position—side 30 degrees lateral position—sitting

3-**Which statement is correct:**

A. Patients who are able to change position while sitting should be taught to shift their weight minimum every 60 min while sitting *
B. In a side lying position, the patient should be at a 90 degrees angle with the bed
C. Shearing forces affect a patient's sacrum maximally when the head of the bed is positioned at 30 degrees

4-If a patient is SLIDING down in a chair, the magnitude of pressure at the seat can be reduced the most by:

A. A thick air cushion *
B. A donut shaped foam cushion.
C. A gel cushion.

5-For a patient at risk of developing a pressure injury, a visco-elastic foam mattress:

A. Reduces the pressure sufficiently and does not need to be combined with repositioning
B. Has to be combined with repositioning every 2 h.
C. Has to be combined with repositioning every 4 h *

6-A disadvantage of a water mattress is:

A. Shear at the buttocks increases.
B. Pressure at the heels increases.
C. Spontaneous small body movements are reduced. *

7-When a patient is lying on a pressure reducing foam mattress . . .

A. Elevation of the heels is not necessary
B. Elevation of the heels is important. *
C. He or she should be checked for 'bottoming out' at least twice a day

Theme 6: preventative measures to reduce the duration of pressure/shear

1-Repositioning is an active preventive measure because . . .

A. The magnitude of pressure and shear will be reduced.
B. The amount and the duration of pressure and shear will be reduced
C. The duration of pressure and shear will be reduced. *

2-Fewer patients will develop a pressure injury if . . .

A. Food supplements are provided.
B. The areas at risk are massaged.
C. Patients are mobilized. *

3-Which statement is correct:

A. Patients at risk lying on a non-pressure reducing foam mattress should be repositioned every 2 h *
B. Patients at risk lying on an alternating air mattress should be repositioned every 4 h Patients at risk
C. lying on a visco-elastic foam mattress should be repositioned every 2 h

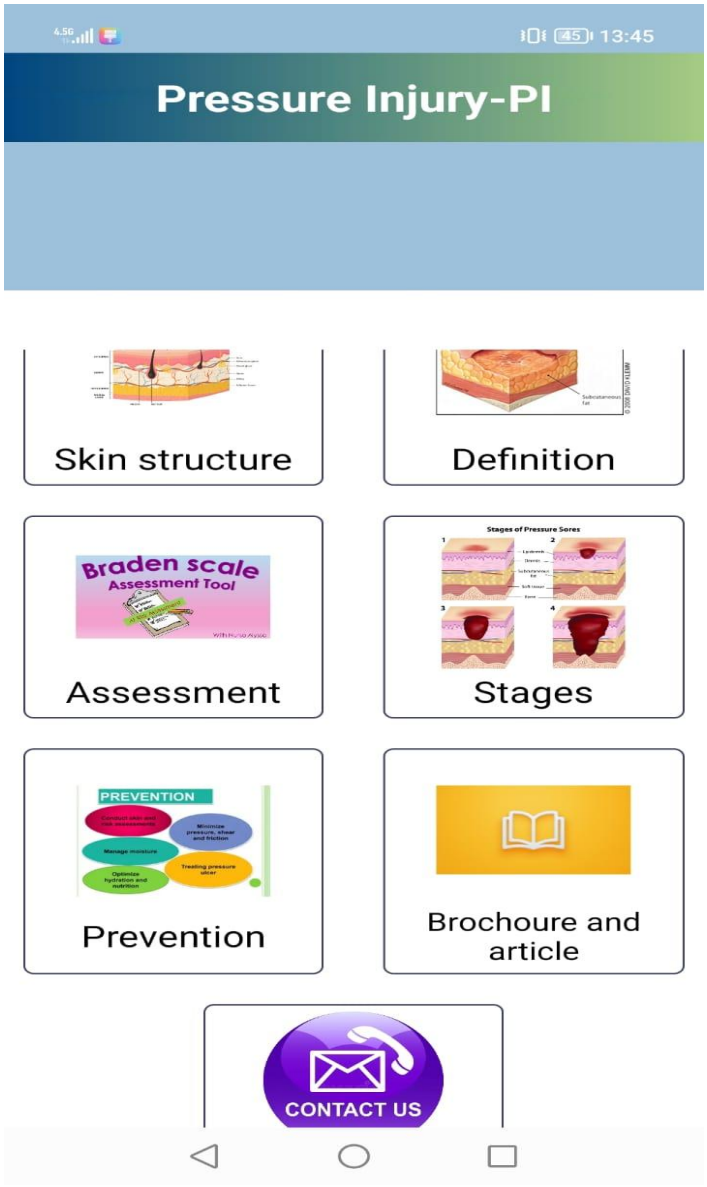
4-When a patient is lying on an alternating pressure air mattress, the prevention of heel pressure injuries includes:

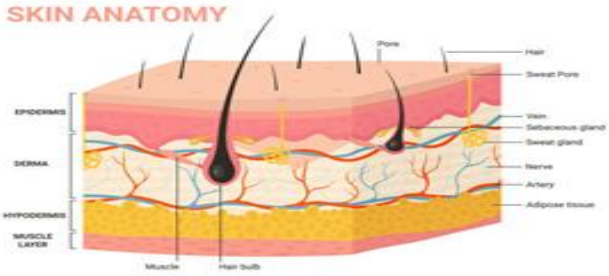
A. No specific preventive measures.
B. A pressure reducing cushion under the heels.
C. A cushion under the lower legs elevating the heels. *

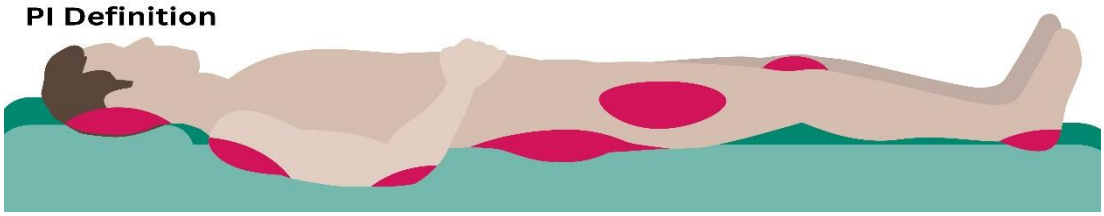
5-If a bedridden patient cannot be repositioned, the most appropriate pressure injury prevention is…

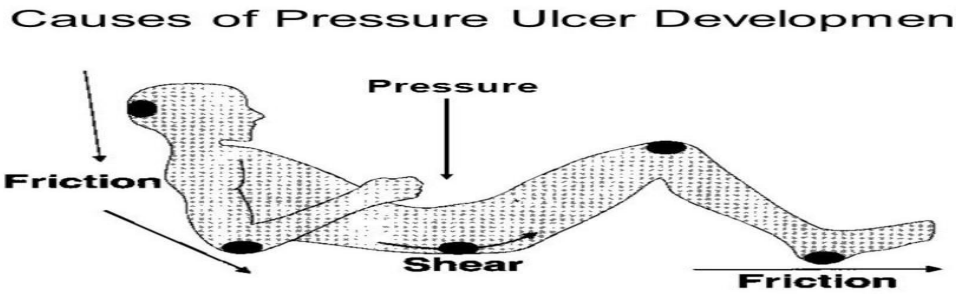
A. A pressure redistributing foam mattress.
B. An alternating pressure air mattress. *
C. Local treatment of the risk areas with zinc paste

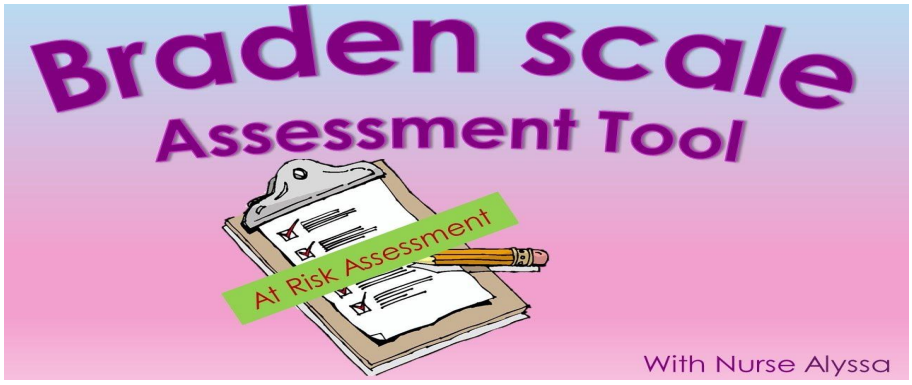
Appendix 4: Mobile Application Contents

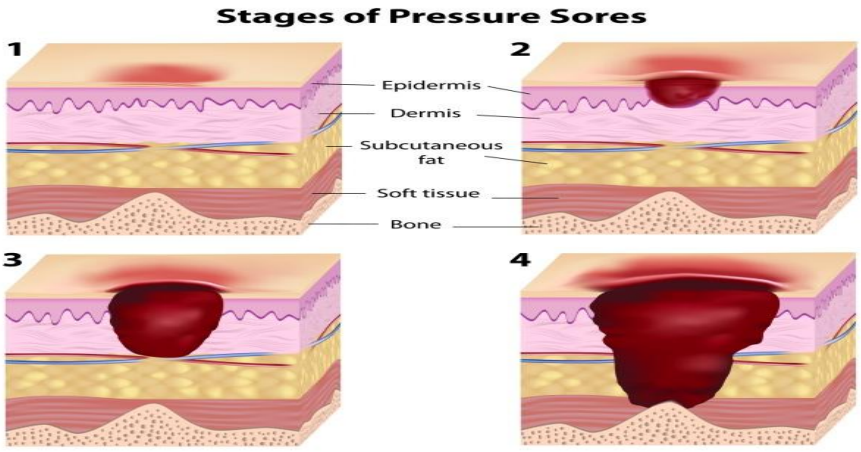



SKIN ANATOMY
EPIDERMIS
DERMA
HYPODERMIS
MUSCLE LAYER
Pore
Hair
Sweat Pore
Vein
Sebaceous gland
Sweat gland
Nerve
Artery
Adipose tissue
Muscle
Hair bulb


PI Definition

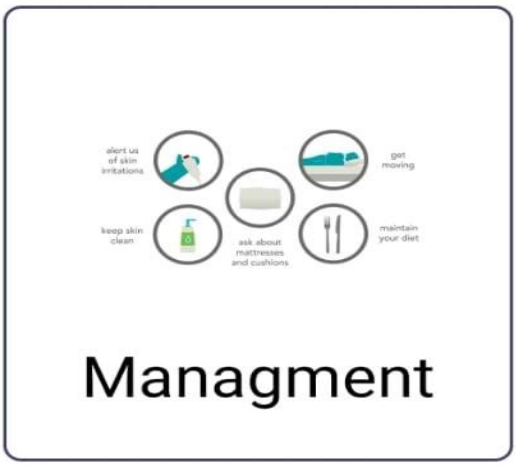

Causes of Pressure Ulcer Development
Pressure
Friction
Shear
Friction


Braden scale
Assessment Tool
At Risk Assessment
With Nurse Alyssa


Stages of Pressure Sores
1
2
3
4
Epidermis
Dermis
Subcutaneous fat
Soft tissue
Bone


PREVENTION
Conduct skin and risk assessments
Minimize pressure, shear and friction
Manage moisture
Treating pressure ulcer
Optimize hydration and nutrition


Dressing and treatment


Managment

Managment of PI

Nutrition

Repositioning and mobility

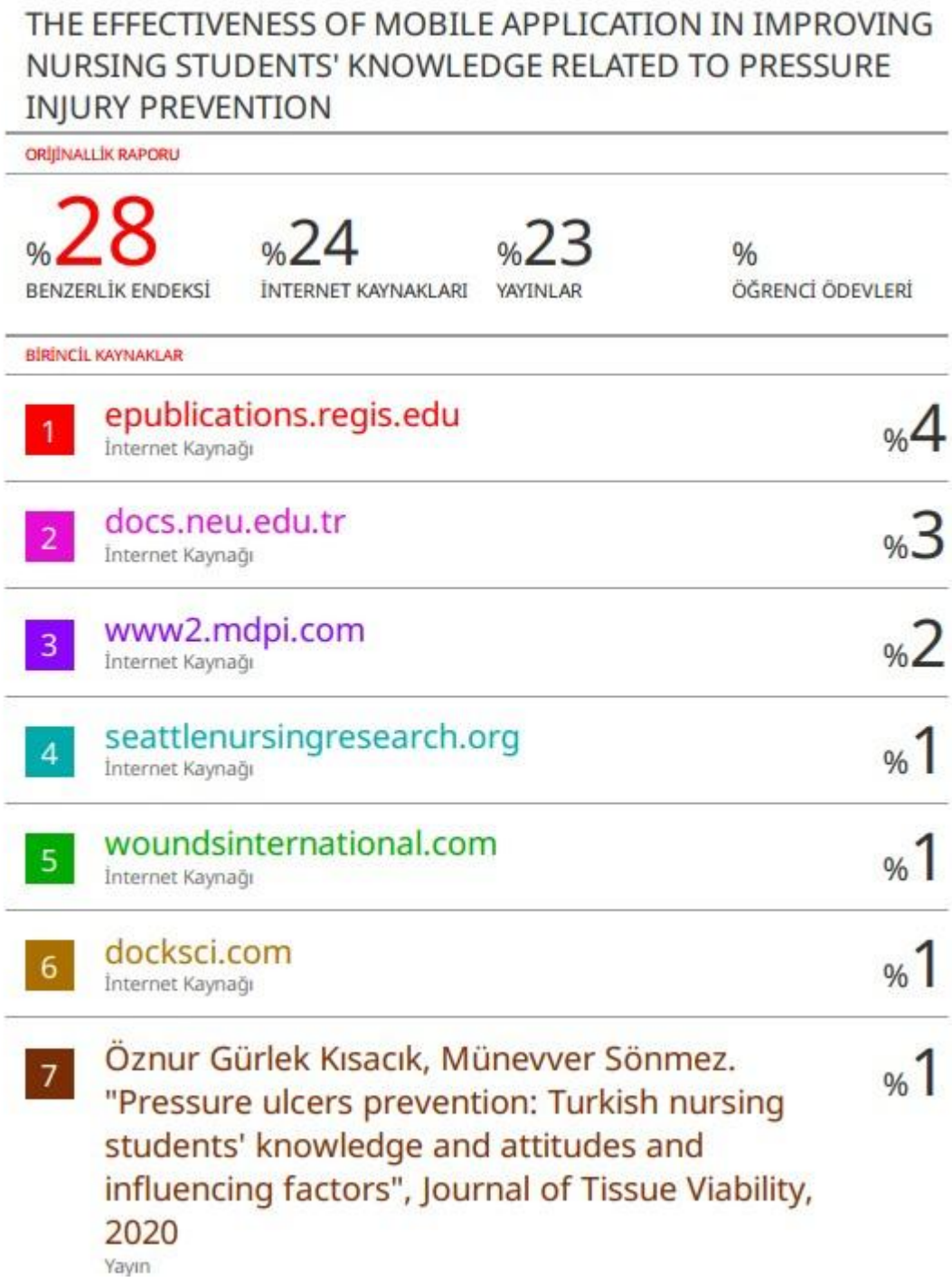
Protocol

Brochure

Article

Contact us

Appendix 5: SIMILARITY REPORT



THE EFFECTIVENESS OF MOBILE APPLICATION IN IMPROVING NURSING STUDENTS' KNOWLEDGE RELATED TO PRESSURE INJURY PREVENTION

ORİJİNALLİK RAPORU

%28	%24	%23	%
BENZERLİK ENDEKSİ	İNTERNET KAYNAKLARI	YAYINLAR	ÖĞRENCİ ÖDEVLERİ

BİRİNCİL KAYNAKLAR

1	epublications.regis.edu İnternet Kaynağı	%4
2	docs.neu.edu.tr İnternet Kaynağı	%3
3	www2.mdpi.com İnternet Kaynağı	%2
4	seattlenursingresearch.org İnternet Kaynağı	%1
5	woundsinternational.com İnternet Kaynağı	%1
6	docksci.com İnternet Kaynağı	%1
7	Öznur Gürlek Kısacık, Münevver Sönmez. "Pressure ulcers prevention: Turkish nursing students' knowledge and attitudes and influencing factors", Journal of Tissue Viability, 2020 Yayın	%1

Appendix 6: CURRICULUM VITAE of AUTHOR

Name	Moath	Surname	Alkhazali
Place of Birth	Jordan	Date of Birth	20\08\1988
Nationality	Jordanain	Tel	
E-mail	malkhazali@eul.edu.tr		

Institution	**Professional qualification, qualification, academic degree**	**Year**	**Country**
Al-albayt University	BSc, Nursing	2013	Jordan
Near East University	MSc		Cyprus
Near East University	PhD		Cyprus
3. Places of employment			
Institution	**Type of sector and occupation**	**Year**	
Islamic Hospital-Jordan	Registered nurse	05-03-2013 24-09-2014	Jordan
Cyprus Science University	Lecturer	01-03-2022 27-06-2022	Cyprus
European University of Lefke	Lecturer	1-09-2022 continue	Cyprus