An-Najah National University

Faculty of Graduate Studies

THE EFFECTIVENESS OF USING THE EDUCATION PROGRAM ON INTENSIVE CARE NURSES' KNOWLEDGE TO PREVENT MEDICAL DEVICE-RELATED PRESSURE INJURIES (MDRPIS)

By

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This Thesis was Defended Successfully on 30/6/2025 and approved by

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Dedication

I dedicate this work to those who have directly and visibly influenced my path. My achievement has been built on the foundation of my family's steadfast love and sacrifice; your support has always given me strength. Thank you for everything, parents whose sacrifice allowed me to bypass and achieve everything and whose faith in me never faltered. To my supervisor, whose practical mentoring and perceptive criticism have made my work easier and more real. To my instructors, whose commitment to instruction and direction has moulded my academic journey. Lastly, I would like to express my sincere gratitude to everyone who has aided my academic and personal development.

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Declaration

I, the undersigned, declare that I submitted the thesis entitled:

THE EFFECTIVENESS OF USING THE EDUCATION PROGRAM ON INTENSIVE CARE NURSES' KNOWLEDGE TO PREVENT MEDICAL DEVICE-RELATED PRESSURE INJURIES (MDRPIS)

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

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Date: 3/8/25

List of Contents

List of Tables

List of Figures

List of Appendices

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Abstract

Background: Using devices intended for diagnostic or therapeutic purposes can lead to pressure injuries related to medical devices. In most cases, the pressure injury that results fits the device's shape or pattern.

Aim: The purpose of the study is to assess how well the educational program has improved the knowledge of intensive care nurses about preventing medical device-related pressure injuries (MDRPIs).

Design: A quasi-experimental research design.

Setting: The study was carried out in a number of An-Najah National University Hospital's (NNUH) intensive care units (ICUs) in Nablus, Palestine.

Subjects: A total of 74 ICU nurses take part in the study.

Instruments: Data were gathered using two main instruments: 1. The Nursing form was utilized to acquire professional and demographic data. A self-report survey called the Medical Device-Related Pressure Injures Knowledge Questionnaire (MDRPI-KQ) evaluated nurses' knowledge and comprehension of MDRPI and various common measures to prevent it from occurring.

Results: The nurses' knowledge improved significantly from 68.2% pre-intervention to 94.9% post-intervention across all subdomains ($p < 0.05$). Indicating a statistically significant improvement across all knowledge domains, which include knowledge, risk factors, staging, prevention, and treatment.

Conclusion: It was demonstrated that the MDRPI prevention and management training program was a successful instrument for raising nurses' awareness and knowledge of the problem while also equipping them with current, evidence-based techniques and expertise.

Recommendation: Institutions should adopt ongoing educational programs, establish MDRPI-specific clinical protocols, and promote evidence-based training for ICU staff.

Keywords: Education Program; Intensive Care Nurses’ Knowledge; Medical Device-Related Pressure Injuries (MDRPIs); Pressure Injury Prevention.

Chapter One

Introduction

1.1 Background

In intensive care units, medical devices are used to treat or diagnose patients who are very sick. These devices, however, have the potential to harm their users by exerting pressure on any part of the body for an extended period (Barakat-Johnson et al., 2019). Foley catheters, nasogastric tubes (NGT), endotracheal tubes (ETT), oxygen masks, and other medical devices are examples of devices that can result in pressure injuries (Sönmez & Bahar, 2022). Conventional pressure injuries, often caused by prolonged immobilization over bony prominences, differ significantly from medical device-related pressure injuries (MDRPIs), which result from localized pressure exerted by external medical equipment. MDRPIs are typically characterized by the distinct shape or pattern of the device, often occurring beneath or adjacent to the device itself, and may involve areas with little subcutaneous tissue or mucosal surfaces. It usually takes the shape of the medical equipment and appears beneath or around it, mirroring the shape of the device. The lack or decrease of adipose tissue in the ulceration sites can cause these pressure injuries to develop into full-thickness ulcers (Pittman & Gillespie, 2020).Based on the World Health Organization (WHO) estimation, a sizable percentage of avoidable injuries in hospitalized patients worldwide is caused by pressure injuries, including MDRPIs (Brophy et al., 2021). These injuries are common in intensive care units (ICUs). Studies show that 60–90% of patients rely on medical devices (Celik et al., 2023). It places additional strain on already overburdened healthcare systems, compromising patient outcomes and increasing healthcare expenses by 20–25% (Gefen et al., 2020).

The expenditure of treating a single pressure level injury is estimation to be around $75,000, which is a startling amount that highlights the significance of preventative measures (Dallı et al., 2022). Sadly, a recent report indicated that 74% of MDRPIs were not detected until they had advanced to Stage III, Stage IV, or were unstageable, even though they are preventable. This suggests that early identification and treatments were lacking (Gefen et al., 2020). Additionally, 63% of cases were not properly documented, indicating clinical practice gaps that impede efficient therapy and prevention (Sönmez & Bahar, 2022).

With significant incidence rates shown throughout the Middle East, MDRPIs are a growing regional concern. Medical equipment was implicated in 38.1% of pressure injuries in Jordan (Najjar et al., 2022). Endotracheal tubes and Foley catheters accounted for 37% of MDRPIs in Saudi Arabia, with traction equipment (1.6%), nasogastric tubes (9.4%), and neck collars (12.5%) following closely behind (Schroeder & Sitzer, 2019). In Egypt, the rate of MDRPIs linked to nasogastric tubes (NGT) was 77.8%, while the rate linked to endotracheal tubes (ETT) was a startling 90% (Zakaria et al., 2018).

Moreover, patients in critical condition are more vulnerable to experiencing MDRPI for a variety of reasons. Long-term use of devices such as nasogastric tubes, endotracheal tubes, and Foley catheters can put pressure on the skin and underlying tissues. It causes tissue ischemia and damage. Patient factors that increase risk include severe nerve damage, being unable to move, poor nutrition, critical illness, sedating medications, and reduced blood flow to tissues (Barakat-Johnson et al., 2019).

Medical devices create pressure, heat, and moisture that can affect the skin around them. These devices often need tight attachment to work properly, which can put pressure on unexpected areas, including over bones. It can also be difficult to monitor under devices because of the straps or tape used to hold them in place. Certain device features increase the risk of medical device-related pressure injuries (MDRPIs), such as constant pressure from hard materials, skin changes from heat and moisture, and poor fit (Gefen et al., 2020). MDRPIs can cause serious problems. These are known as tissue death, local infections, slow wound healing, and body-wide infections like sepsis. These complications make patients suffer more and increase medical costs by making hospital stays longer, increasing readmissions, and requiring more treatments. To address these problems, hospitals need a prevention-focused approach that emphasizes early action (Gefen et al., 2020).

Preventing pressure injuries from medical devices is a unique challenge for ICU nurses. Nurses should be able to check the skin under and around medical devices, recognize the stages of pressure injury, and secure devices properly to prevent them from moving, and put on and remove devices according to the manufacturer's instructions (Galetto et al., 2021).

MDRPIs often receive insufficient clinical attention despite their serious impact. Research shows that healthcare providers have poor awareness and understanding of MDRPIs. Several factors cause this gap, including a lack of clear risk assessment and management guidelines, poor integration of prevention methods into nursing and medical education, and limited training on these strategies. The problem deteriorates because of inconsistent documentation practices and a lack of research on device-specific risks (Erzincanlı et al., 2024; Kurtgöz et al., 2024; Najjar et al., 2022; Sönmez & Bahar, 2022).

Complete educational programs are essential for giving nurses the knowledge to prevent MDRPIs. Focused training programs have been shown to greatly improve nurses' understanding of risk factors, early identification, and evidence-based prevention techniques. For example, practical workshops, simulation-based learning, and ongoing education on risk assessment tools have successfully reduced MDRPI rates. These programs also encourage following best practices, including regular skin checks, proper device selection, and repositioning procedures, which helps create a culture of patient safety (Çakar & Karadağ, 2024; Sayed et al., 2022; Sönmez & Bahar, 2022).

Healthcare systems can reduce MDRPI rates and effects by focusing on complete educational programs, investing in advanced prevention methods, and encouraging cooperation between countries and regions. Collaborative work can ensure better patient care and outcomes, as well as greatly reduce the financial burden on healthcare systems worldwide. In addition to being a therapeutic necessity, addressing MDRPIs is also a moral and ethical obligation to protect each patient's well-being (Dallı & Girgin, 2024; Sayed et al., 2022).

Finally, a variety of teaching and learning techniques are coordinated, and activities are meticulously designed in the educational program developed for this study. The goal is to improve nurses' understanding of pressure injuries from medical devices by giving them complete knowledge and current information. Following these priorities, this study aims to find out how well an educational program works in improving ICU nurses' knowledge about preventing MDRPIs.

1.2 Problem Statement

In modern healthcare, MDRPIs are a major global problem that is often overlooked, especially in intensive care units (ICUs), where patients depend heavily on life-saving medical equipment (Barakat-Johnson et al., 2019). These injuries happen from constant pressure from devices like Foley catheters, breathing tubes, and feeding tubes. They are complex and can cause serious problems if not managed properly. Starting as local skin injuries, these can get worse over time, causing pain, visible scarring, and infections like sepsis. They may also lead to reduced quality of life, changes in body image, and permanent hair loss. Also, MDRPIs are associated with prolonged hospitalization and increased healthcare utilization

Higher use of resources, and major effects on the patient's body image and self-esteem, often requiring expensive cosmetic procedures (Barakat-Johnson et al., 2019; Gefen et al., 2020). MDRPIs also harm patient quality of life and stress healthcare systems by increasing readmission rates, making hospital stays longer, and raising healthcare costs (Gefen et al., 2020). Even though MDRPIs are common and serious, the topic remains underexplored in the current literature , especially in areas like Palestine (Omar et al., 2024). Research shows that nurses do not understand these injuries well enough, leading to poor prevention actions and putting patients at risk for complications (Gefen et al., 2020; Sönmez & Bahar, 2022).

Globally, MDRPIs affect more than one-third of patients (Sönmez & Bahar, 2022). Research consistently shows information gaps, poor risk assessment practices, and a lack of standard prevention guidelines. Different documentation standards and a lack of research on device-specific risks make these problems worse. This knowledge gap prevents effective prevention and management of MDRPIs, especially in high-risk settings like intensive care units (ICUs), where 60–90% of patients use medical devices, making them very vulnerable (Celik et al., 2023). Regional studies, especially in the Middle East, show concerns about MDRPI rates with specific devices. This highlights the urgent need for prevention measures and focused educational programs (Najjar et al., 2022; Schroeder & Sitzer, 2019; Zakaria et al., 2018).

ICU nurses are essential in solving this problem because they are at the forefront of patient care and device management. Improving their knowledge and skills through evidence-based educational programs is key to reducing MDRPI occurrence, minimizing complications, and improving patient outcomes (Çakar & Karadağ, 2024). This research aims to address these challenges by evaluating how well a complete educational program works to give ICU nurses the necessary skills to prevent MDRPIs. The research seeks to decrease MDRPI rates and effects and improve patient care. It also aims to reduce the financial burden on healthcare systems by raising awareness, encouraging best practices, and implementing focused training programs.

1.3 Significance of the study

Based on clinical observations at An-Najah University Hospital, pressure injuries caused by medical devices are a major problem for critically ill patients. MDRPIs remain insufficiently addressed in clinical practice, as highlighted by direct observations and reports from frontline practitioners. Pre-existing conditions connected to pressure injuries can exacerbate the patient's health and negatively impact their outcomes.

According to a prior study, 70% of medical device-related pressure injuries in the intensive care unit were caused by medical equipment, and almost one-third of patients suffer from such injuries (Sönmez & Bahar, 2022). To reduce these problems, nurses' education programs on medical device preventative measures related to pressure injuries are crucial (Sönmez & Bahar, 2022).

1.4 Statement of Purpose

The purpose of this study is to evaluate the effectiveness of a structured educational program in enhancing intensive care nurses' knowledge related to the prevention and management of medical device-related pressure injuries (MDRPIs) in the Palestinian healthcare context.

1.5 Objectives

1. To evaluate ICU nurses' baseline knowledge of MDRPIs before and after the implementation of the educational program.
2. To assess the impact of the educational program on nurses' knowledge about the prevention and management of MDRPIs.

3. To determine whether demographic variables (e.g., age, professional experience, educational level, and prior training) significantly influence post-intervention knowledge scores

1.6 Research Question

1. What are the levels of nurses' knowledge regarding MDRPIs pre- and post-educational programs?

2. What are the levels of nurses' knowledge domains about risk factors connected to MDRPIs pre- and post-educational program?

3. What are the nurses' staging-related knowledge levels regarding MDRPIs pre- and post-educational programs?

4. What are the levels of nurses' prevention and treatment knowledge about MDRPIs pre- and post-the educational program?

5. What are the total nurses' knowledge levels regarding MDRPIs pre- and post-the educational program?

1.7 Hypotheses

Null hypothesis (H_0):

1. There is no statistically significant impact of the implementation of the educational program on improving nurses' knowledge regarding MDRPIs at the level of significance (α) ≤ 0.05.

2. There is no statistically significant influence of the implementation of the educational program on improving nurses' knowledge about risk factors related to MDRPIs at the level of significance (α) ≤ 0.05.

3. There is no statistically significant impact of the implementation of the educational program on improving nurses' staging-related knowledge about MDRPIs at the degree of significance (α) ≤ 0.05

4. There is no statistically significant impact of the implementation of the educational program on improving nurses' prevention and treatment knowledge regarding MDRPIs at the level of significance (α) ≤ 0.05

5. There is no statistically significant impact of the implementation of the educational program on improving the total nurses' knowledge about MDRPIs at the level of significance (α) ≤ 0.05.
6. There are no statistically significant differences at the 0.05 level in the total level of nurses' knowledge regarding MDRPIs in the educational program according to demographic characteristics (Gender, Marital Status, work experience, Graduation from a Nursing Program, Department, Position, and Training).

1.8 Literature Review

1.8.1 Introduction of Literature Review

The knowledge, attitudes, and preventative strategies of intensive care unit (ICU) nurses about MDRPIs are examined in this review of the literature. It examines the frequency, severity, and characteristics of MDRPIs in adult intensive care unit patients, as well as the variables influencing ICU nurses' awareness, perspectives, and actions regarding MDRPI prevention. Additionally, the review assesses the impact of implementing educational programs on preventive nursing measures for MDRPIs, focusing on their effects on nurses' performance.

Search Engines: PubMed, Google Scholar, Cochrane, & Science Direct.

Keywords: MDRPIs, Continuous Education Program (CEP), Nurses' Competencies, Nurses' Performance, Pressure Injury Prevention, Intensive Care Unit (ICU), Nursing Education, Knowledge Enhancement, Patient Outcomes & Healthcare Quality Improvement.

Research method: A systematic approach was used to find relevant studies for this study. Keywords were used to search different academic databases for articles related to the research topic. Abstracts of the found articles were reviewed to check if they were relevant to the study. Relevant studies were saved or linked to a Word document for further review. Each selected article was carefully evaluated for how useful it could be

in addressing the research aims. After thorough reading and analysis, the insights and findings from these articles were included in the study framework as needed.

1.8.2 Review of relevant literature

- **An Overview of Pressure Injuries (PIs) and MDRPIs: Definitions and Key Differences:**

Pressure injuries (PIs) occur when force is applied to the skin's surface over bony areas. The National Pressure Injury Advisory Panel states that pressure injuries can develop under medical devices anywhere on the body, and the damage can replicate the device's shape or pattern (Kottner et al., 2019). This force can include friction, shearing between the skin and another surface, or continuous pressure on the skin. MDRPIs are a type of pressure injury defined as localized damage to the skin and underlying tissue, including mucous membranes, caused by pressure from an external medical device at the injury site. MDRPIs replicate the device's shape (Edsberg et al., 2016; 2016; Pittman & Gillespie, 2020). Unlike regular pressure injuries, MDRPIs do not usually occur over bony areas. They commonly happen in places that are not easily visible or have little soft tissue, such as the bridge of the nose, ears, face, trunk, crotch, underarms, or wrists where medical equipment is used (Gefen et al., 2020). Medical devices that touch or go through a patient's skin can greatly increase MDRPI risk. Common devices linked to MDRPIs include respiratory equipment (oxygen tubing, nasal cannulas, face masks for non-invasive positive pressure ventilation), cervical collars, nasogastric tubes, endotracheal tubes with tube holders, vascular access devices for intravenous drug or fluid administration, splints, casts, and urinary catheters for bladder drainage (Duerst et al., 2022; Saleh & Ibrahim, 2023).

- **Statistics and Risk Factors of MDRPIs**

The substantial impact of MDRPIs on patient care is demonstrated by the fact that they make up almost one-third of every hospitalized pressure injury setting (Gefen et al., 2020).

- **Occurrence by Setting**

A recent systematic review of MDRPIs in intensive care units (ICU) showed incidence rates from 0.9% to 41.2% and prevalence rates from 1.4% to 121%. This compares to 0.4% in general wards. The higher rates in ICUs are likely because more devices are used in ICU settings than in general wards.

- **Occurrence by Anatomical Location**

According to Gefen et al. (2020), the most common sites for MDRPIs are the face, ears, sacrum/coccyx, heels, and buttocks. This shows the importance of targeted prevention actions in these high-risk areas.

- **Occurrence by Type of Device**

Up to 68% of MDRPIs are related to respiratory equipment. Of these, 20% are linked to continuous positive airway pressure (CPAP) and bilevel positive airway pressure (BiPAP) devices. According to Gefen et al. (2020), these injuries often appear as ulcers on the nasolabial fold or nose bridge.

- **Neonates, Infants, and Pediatric Patients**

Neonates, babies, and pediatric patients are at particular risk due to their advanced metabolic rates and physiological swelling, which are common in critically ill children. MDRPI rates in pediatric populations may reach 28%. Non-invasive mechanical ventilation systems play a major role in causing injuries, with a relative risk ratio of 12:24 (Gefen et al., 2020).

- **Cost of MDRPIs**

MDRPIs create huge financial problems that get worse as people age and more develop diabetes. In the US alone, pressure ulcers from hospitals cost $26.8 billion every year. England's NHS spent over £530 million on pressure ulcers in just one year (May 2012 to April 2013) (Gefen et al., 2020).

- **Classification and Early Detection of MDRPIs**

MDRPIs can be categorized using the standard Pressure Injury (PI) system (Edsberg et al., 2016). These wounds often turn into deep ulcers, especially in areas with little fat tissue (Kayser et al., 2018). Most MDRPIs show up as Stage 1 injuries (54.1%) or Stage 2 injuries (15.3%) (Dang et al., 2022). About 28% of patients develop MDRPIs within 3

to 5 days of using medical devices (Celik et al., 2023). This means nurses need to watch for these injuries early and prevent them.

- **Recent Studies and Findings on MDRPIs: Incidence, Risk Factors, Prevention, and Nursing Knowledge**

MDRPIs can be categorized using the established Pressure Injury (PI) stage method (Edsberg et al., 2016). These lesions often progress to full-thickness ulcers, especially in areas with little or no adipose tissue (Kayser et al., 2018). Dang et al. (2022) report that Stage 1 injuries (54.1%, 53/98) and Stage 2 injuries (15.3%, 15/98) are the most common manifestations of MDRPIs. Within three to five days of employing medical devices, MDRPIs are found in about 28% of patients (Celik et al., 2023). These results underscore the vital need for early detection and stringent preventive measures to halt the progression of these injuries.

The purpose of this cross-sectional study was to determine the factors influencing critical care nurses' understanding of MDRPIs and to assess their level of familiarity with them. The study, which involved a convenience sample of 71 nurses who completed the MDRPIs Knowledge Questionnaire in 2024, was conducted at a large medical facility in Palestine. The findings highlight that inadequate knowledge of MDRPIs can negatively impact patient care. Therefore, developing targeted training programs and policies based on nurses' knowledge and practices is essential to effectively enhance prevention and administration strategies.

A cross-sectional study conducted between October 2018 and March 2019 examined the prevalence of MDRPI and its risk factors among 694 patients in 66 adult intensive care units (ICUs) at 30 hospitals in China. The National Pressure Ulcer Advisory Panel's definitions were used to stage each MDRPI. The study followed STROBE guidelines. Results showed that the prevalence of MDRPI remained high. To reduce MDRPI rates, nurses should consider these risk factors when caring for ICU patients and implement appropriate prevention measures. A separate prospective observational study investigated the development, characteristics, and risk factors of MDRPIs in ICUs. MDRPI occurred in 27.2% of patients, with the majority developing in the mouth and nose areas, according to the survey, which comprised 302 individuals who were admitted to the hospital within a year. The STROBE Declaration was followed in the

reporting of the study. The majority of orthopedic devices, fasteners, and non-invasive ventilation and oxygen masks drove the development. Hospitalization days in the intensive care unit and the quantity of medical devices utilized were significant determining risk factors, accounting for 28.3% of the variance in MDRPI development overall. The quality of nursing care is at risk due to the high rate of MDRPI development.

Researchers in Ankara, Turkey, studied 355 nurses from December 2020 to March 2021 to see how much they knew about MDRPIs. They used a basic information form and a knowledge questionnaire to collect the data. According to the findings, just 23.1% of nurses are generally aware of these injuries. The study discovered that nurses' mean scores on the MDRPIs Knowledge Questionnaire varied significantly depending on their gender, experience working in an intensive care unit, and prior training. The study concludes that nurses lack sufficient knowledge about these injuries and recommends regular training sessions to reduce the rate of these injuries and deliver high-quality care.

To evaluate nursing students' attitudes and understanding of MDRPIs and the factors influencing them in Turkey, a descriptive and cross-sectional study was conducted. Between January and May 2024, 581 nursing students participated in the study. The Medical Device-Related Pressure Injury Attitude Questionnaire (MDRPI-AQ), the Medical Device-Related Pressure Injury Knowledge Assessment Test (MDRPI-KAT), and the Student Information Form were used to gather data. According to the survey, Turkish nurses have a 75.0% positive attitude regarding MDRPI prevention and care; however, 54.7% of them lack the appropriate expertise. Preventive nursing interventions, classification, and patient groups at risk are the areas that require the most excellent attention. Knowledge can be enhanced by clinical experience and training in these fields. More positive views about care practices and preventive measures are correlated with higher levels of expertise. Strengthening training curricula, providing clinical experience, and implementing continuing education programs can improve knowledge and attitudes towards MDRPI management.

In 2023, a quantitative cross-sectional study was conducted to investigate the relationship between factors affecting ICU nurses' knowledge, attitudes, and practices regarding MDRPIs and the prevalence of these injuries in critically ill patients. The Clinical Nurses' Knowledge, Attitude, and Practice Questionnaire for the Prevention of

MDRPI in Critically Ill Patients was administered to 322 intensive care unit nurses from Chinese tertiary institutions between January 1, 2022, and June 31, 2022. A 72% passing rate was found in the findings. A variety of characteristics, including years of employment, professional title, training, and educational background, influenced MDRPI's knowledge, attitude, and practice. Professional titles, years of job experience, training, and a high level of education were found to be overlaid and synergistic. To increase ICU nurses' understanding of MDRPI and lower patient occurrence, the study recommends creating efficient scheduling systems and MDRPI training courses.

A quasi-experimental study was conducted at the Tanta University Emergency Hospital's Surgical Intensive Care Unit in 2022. The purpose of this study was to evaluate the impact of an educational program on clinical outcomes for patients and nurses, with a focus on MDRPIs. Three instruments for gathering data were used:

- Tool (I) collected nurses' demographic characteristics and assessed their knowledge about MDRPIs.
- Tool (II) was an observational checklist used to evaluate nurses' practices.
- Tool (III) assessed patients' clinical outcomes.

Seventy nurses participated in the trial, and sixty critically sick adults were purposefully sampled and split into two groups of thirty each. The overall mean ratings of nurses' knowledge and practices significantly improved as soon as the program was implemented, according to the data. Over time, though, this improvement waned.

The purpose of a pre-posttest intervention study was to evaluate the impact of training on MDRPI prevention on the knowledge, preventive performance, and point prevalence of intensive care unit nurses. ICU nurses participated in the study in three stages from May to July 2023: pre-training (E0) (104 nurses, 116 patients), training implementation (E), and post-training (E1) (89 nurses, 120 patients). The study consisted of three stages: pre-training, implementation, and post-training. A variety of methods were employed to gather data, including MDRPI follow-up, performance observation checklists, knowledge evaluation questionnaires, Braden Pressure Ulcer Risk Assessment scales, pressure injury grading, patient and nurse characteristics, and feedback forms.The

MDRPI knowledge levels significantly increased, especially in the staging and prevention themes, according to the results.

Additionally, MDRPI preventive performance improved dramatically. The study found that MDRPI training improved preventive performance and knowledge, but further research with larger sample sizes is required. To reduce MDRPIs in ICUs, nurses need to get medical device sizing right, secure devices properly, check skin regularly, and use good prevention methods.

Researchers in Saudi Arabia tested whether a prevention program called SKINCARE could reduce MDRPIs in critical care patients. They worked with 400 nurses across three ICUs from January to April 2020. The SKINCARE program included hygiene practices, repositioning patients, regular skin checks, and specific treatments to prevent MDRPIs - which are injuries caused by pressure from medical devices. The program worked. It significantly cut down on new MDRPIs by improving how nurses care for patients' skin.

A previous systematic review study aimed to compile research on pressure injury prevention strategies related to medical devices for critically ill patients. The pressure injury incidence dropped from 8.1-96.7% prior to intervention to 0.3-53.3% following intervention in the twelve articles. Nurse education, evaluation, documentation, and treatments such as repositioning, cleanliness, and emergency therapy are examples of strategies. Hydrocolloid foam dressings and transparent hydrocolloid formulations were among the pressure injury dressings that successfully decreased incidence rates. Specialized techniques for various medical devices and pressure injury locations should be the primary focus of future research.

A significant amount of research is being conducted to prevent MDRPI, as it is a prevalent issue. Nevertheless, there aren't many systematic reviews of techniques and solutions available. Interventions include clothing, full-face masks, hyperoxygenated fatty acids, training, multidisciplinary education, and the use of specific securement devices, according to a systematic analysis of 24 peer-reviewed publications. Six databases were searched, without regard to the year of publication, including Medline, CINAHL, EMBASE, Cochrane Library, Web of Science, and ProQuest. According to the study's findings, considerable effort has been invested in developing MDRPI

prevention techniques. Although a variety of devices have been reported, it is clear that further research is needed.

Investigating the efficacy of therapies to avoid pressure damage in adults admitted to critical care units was the goal of a systematic review and meta-analysis of randomized controlled trials. In mid-2019, a systematic review and meta-analysis of 26 studies were carried out using five databases (CINAHL, MEDLINE, Scopus, Web of Science, and Embase) with an emphasis on pressure injury prevention treatments in acute hospital settings. According to the findings, pressure damage in people in critical care units could only be successfully avoided using preventative sacrum and heel dressings. All intervention types require further intensive care-specific studies, and future research should be conducted and published by relevant standards and recommendations to minimize bias. To reduce bias, the study emphasizes the need for further studies tailored to critical care.

To determine the prevalence and risk factors for MDRPI, a cross-sectional study was conducted among adult patients (aged 18 years or older) admitted to an intensive care unit (ICU) at a Brazilian referral hospital between December 2019 and February 2020. Patients who agreed to participate had their skin examined for the presence of an MDRPI, and all medical instruments were used. From the medical records, additional independent variables were extracted, including sociodemographic characteristics, medical history, risk factors for pressure injuries, prescription drugs, and duration of hospitalization. According to this study, pressure injuries from medical devices were common in individuals between the ages of 15 and 97. Since the majority of these accidents were stage 1, regular monitoring and, when practical, device relocation may help avoid more serious injuries. Further studies involving other Brazilian institutions are needed to better understand the risk factors and prevalence of MDRPIs in patients in intensive care units.

Finding the traits of MDRPI in Jordanian adult intensive care patients was the goal of another study. Due to a lack of comprehensive clinical examination, the true scope of MDRPIs—which are serious health issues among hospitalized patients—is underestimated. A total of 329 adult patients from three sizable teaching and referral centers participated in the study, and a screening questionnaire was used to collect data. MDRPI, which is defined as a pressure injury on the skin or mucous membrane caused

by a medical device in use, was the main result. Only 177 preventative and treatment interventions were given to 15 patients during two weeks, according to the study. The report suggests more research to monitor MDRPI prevention and treatment practices among patients in intensive care units.

As part of a doctoral dissertation in nursing practice from the University of the Incarnate Word, a Quality Improvement Project was carried out in the intensive care unit (ICU) of Hospital X in the United States in 2021. In comparison to the national standard, the medical-surgical intensive care unit had a high proportion of hospital-acquired pressure injuries, which the initiative sought to remedy.

- The project's main goal was to prevent hospital-acquired pressure injuries by collaborating with interdisciplinary team members to develop an evidence-based instructional suite. A simultaneous integumentary examination using a standardized scale and visual documenting of high-risk anatomy followed the instructional session, which was held in a special classroom.

- Forty-three (90%) of the forty-eight nurses came to the educational suite and completed the evaluation. The project demonstrated the dedication of the personnel to raising the standard of care for the integumentary system. It is viewed as the beginning of numerous ongoing improvement processes.

- To investigate the knowledge, attitudes, and prevention performance of intensive care unit (ICU) nurses regarding multidrug-resistant pathogens (MDRPs), a cross-sectional survey was conducted in 2022 by the STROBE Guidelines.

The research was conducted utilizing the MDRPI Knowledge Assessment Questionnaire. The results showed that nurses had an average knowledge score of 68.4% on MDRPIs, with the highest percentage of accurate response in skin evaluation (83.6%). The total score did not significantly correlate with specializations, age, or job experience, according to the study. On the other hand, master's degree holders and women scored higher. The results have the potential to enhance nursing policies and practices in acute care environments.

1.8.3 Summary of the Literature Review

In conclusion, the reviewed literature emphasizes the high prevalence and significant impact of MDRPIs in critical care settings. Device type, anatomical location, and patient demographics influence MDRPI risk. The effectiveness of preventive bundles, targeted treatments, and educational programs in reducing the incidence of MDRPI is supported by evidence. To improve these tactics, ensure durability, and refine therapies for various clinical conditions, further research is still required. However, no interventional studies to date have assessed the effect of educational programs on ICU nurses' knowledge of MDRPI prevention in the Palestinian context

Matrix Chart/Table for Studies Regarding MDRPIs (See the table in appendix A_1)

1.9 Conceptual definitions

- The use of gadgets intended for medicinal or diagnostic purposes leads to MDRPIs. According to Edsberg et al. (2016), these injuries typically follow the shape or pattern of the device.

- A device-related pressure injury occurs when an external medical device is utilized at the ulcer site, causing localized harm to the skin and/or underlying tissue, including mucous membranes. The device's shape is reflected in the injury (Pittman & Gillespie, 2020).

1.10 Operational definitions

- The MDRPI-KQ is a specialized tool developed to evaluate the knowledge levels of healthcare professionals regarding medical device-related pressure injuries (Sönmez & Bahar, 2022).

1.11 Framework

1.11.1 Theoretical Framework

This study uses the Donabedian model. It studies three key areas: structure, process, and outcome. It's a well-known way to measure healthcare quality. The model fits perfectly with what we're trying to do - see if an educational program actually improves how ICU nurses prevent MDRPIs. The structure covers things like resources and training. The process looks at what nurses actually do. Outcome measures whether patients get better

care. These three areas connect to each other. Understanding how they work together helps improve healthcare (Ghofrani et al., 2024). So, if we train nurses better (structure), they should use better prevention methods (process), which should mean fewer pressure injuries (outcome).

1.11.2 Structure

Structure means having the right setup to run the educational program. This includes enough qualified nurses, hospital policies that support patient safety, and resources for continuing education; without a supportive hospital environment, even the best training will not work. Nurses need backup from their institution to actually use what they learn about preventing MDRPIs.

1.11.3 Process

The process domain focuses on what happens during the educational program. This covers training sessions, clinical guidelines, and getting evidence-based practices into everyday care. Basically, it is about how the program changes what ICU nurses know about preventing MDRPIs.

1.11.4 Outcome

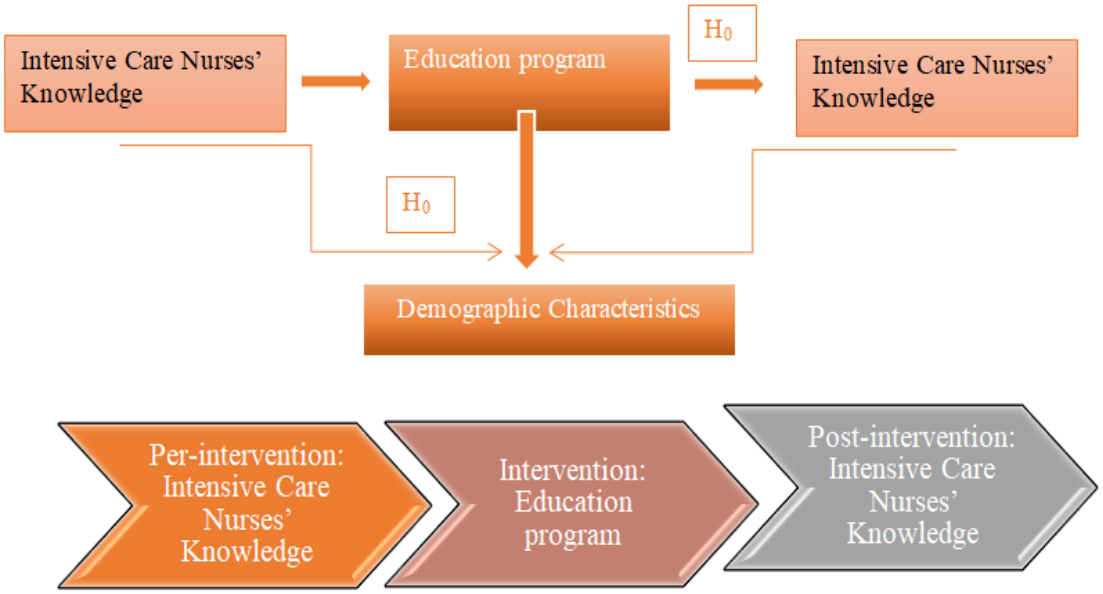
The outcome domain studies whether the educational program actually worked and if ICU nurses learn more about preventing MDRPIs. It also studies using better prevention methods. These results show that the program did what it was supposed to do to improve patient care in intensive care units. (See the table in Appendix A2 for examples of the Donabedian Model components)

1.11.5 Conceptual framework

The conceptual framework shows how the educational program leads to better nurse knowledge, which improves clinical practice and patient outcomes. This study aligns with the Donabedian model's three components: structure (available resources), process (actual activities), and outcome (results achieved).

Figure 1

Conceptual map



Chapter Two

Method

2.1 Introduction

This chapter describes the research design, population selection, sample techniques, and data management procedures utilized to produce the study's findings.

2.2 Description of research design:

The effectiveness of an educational program provided to critical care nurses on care and prevention management for MDR-TB was assessed using a quasi-experimental pre-posttest (before-after) quantitative study design. The objective of this design is to enhance nurses' understanding of how to prevent MDRPIs by evaluating their knowledge both before and after the program's implementation.

- **Symbolic representation:**
- **One group pertest-posttest designs:**

O1 X O2

1. **O1: Pre-test (Baseline Measurement)**

This represents the initial assessment of nurses' knowledge regarding the care and prevention of MDRPIs prior to the educational program. It serves as a baseline to compare with post-test results.

2. **X: Intervention (Educational Program**)

It represents the implementation of the educational program provided to the participants.

3. **O2: Post-test (Follow-up Measurement)**

This evaluation assesses nurses' knowledge after the educational program has been implemented. The impact of the program will be shown by comparing O1 and O2.

Symbolic Representation of Study Design (see the table in Appendix A_3)

2.3 Identification of the population and sample

2.3.1 Population

A variety of intensive care units (ICUs) including the Medical Intensive Care Unit (MICU), Surgical Intensive Care Unit (SICU), Pediatric Intensive Care Unit (PICU), and Cardiac Care Unit (CCU) at An-Najah National University Hospital (NNUH), on the West Bank of the Palestinian Territories employ critical care nurses, who are the study's target demographic.

2.3.2 Sample size

The sample size for this study was determined using the ROASOFT sample size calculator, which had the following parameters: a population size of 75, a response distribution of 50%, a margin of error of 5%, and a 95% confidence level. This computation determined a minimal sample size of sixty-three participants. The adjusted sample size was expanded to 70 participants to account for an estimated 10% attrition rate. The suitability of the sample size was verified by speaking with a biostatistician. To assess the suitability of the data collection procedure and instruments, a pilot study was conducted with 15 nurses from the Post Cardiac Care Unit (PCCU).

2.3.3 Sampling Criteria (Eligibility Criteria)

A. Inclusion criteria:

- Position: Registered nurses working in intensive care units (ICUs) at An-Najah National University Hospital (NNUH).
- Experience: Nurses must have at least six months of experience in their respective ICU settings.
- Department: Variety of intensive care units (ICUs)

B. Exclusion Criteria:

- Leave of Absence: Nurses who were on leave during the study period.
- Declined Participation: Nurses who chose not to participate in the study.
- Outpatient Services: Nurses working in units that provide outpatient services were excluded from the study.

- Open Ward Units: Nurses working in open ward units/general care units were excluded from the study.

- Participants who were part of the pilot study were excluded from the main analysis to avoid overlap and to maintain the integrity of the study sample, which was nurses' work in the Post Cardiac Care Unit (PCCU).

2.3.4 Sampling method

Participants were carefully selected from among those who met the participation criteria using a convenience sampling method. The selection was not random but rather subject to specific controls to ensure their suitability for the study objectives.

2.4 Setting

The location for the study, Nablus, Palestine, was deliberately selected based on its accessibility and the unique challenges posed by the ongoing Israeli-Palestinian conflict. An-Najah National University Hospital (NNUH), a private medical facility with specialized intensive care units, was chosen as the study site. Established in 2014 as the first medical teaching centre in the region, NNUH is a leading healthcare and academic institution in Palestine. The hospital aims to improve healthcare quality, support health education, and promote scientific research. Initially, it started with 100 beds, four operating rooms, and an emergency department, later expanding to 140 beds, five intensive care units (Medical intensive care units MICU, surgical intensive care unit SICU, pediatric intensive care unit PICU, cardiac care units CCU & Post Cardiac Care Unit PCCU) and a team of 80 nurses. The hospital operates the nation's first bone marrow transplant facility for adult leukemia patients and provides specialized services including organ transplants, advanced liver surgeries, open heart procedures, and pediatric blood disorder treatments. NNUH is also recognized for its expertise in women's health, vascular surgery, kidney medicine, and cancer treatment.

To support its healthcare and education goals, NNUH established a Clinical Education and Training Center and a Clinical Research Center. These centers advance academic work and address health problems in Palestinian society. The hospital's Professional Development Program in Nursing, started in 2014, emphasizes ongoing education and independent learning to help nurses provide high-quality patient care. NNUH became the first Palestinian medical center accredited by the Joint Commission International

(JCI) for healthcare quality and safety and received a four-star rating from Statista and Newsweek, demonstrating its commitment to international standards and healthcare innovation.

2.5 Measurement Method

The Nurse Information Form and the MDRPI-KQ-Self-report- were used as data collection tools. An open-access version of the questionnaire was utilized, and permission to use it was obtained by sending an email to the author (see Appendix D).

- **Nurse Information Form and MDRPIs Knowledge Questionnaire (Sönmez & Bahar, 2022)**

1) Part A: study instrument

Part A collects information about the participating nurses through 18 questions organized into two sections. The first section gathers socio-demographic data, including age, marital status, and educational level. The second section focuses on professional qualifications such as academic background, years of experience, and specialized training. This information supports the study objectives and ensures reliable results

- **Section 1: Sociodemographic Characteristics:**

A. This section aims to gather basic demographic and work-related information about the nurses to understand the context of their experiences and qualifications.

B. Age: This item requests the nurse's age in years. It indicates the nurse's age group, which might influence their approach or experience in the field.

C. Gender: Male/female: this item allows the classification of participants based on gender, offering insight into the gender distribution of the nursing workforce in the context of the study.

D. Marital Status: Married/Single: information about the marital status of the nurse is collected here, which could be useful to understand personal circumstances that may influence their work-life balance.

E. Work Experience: This question categorizes the years of work experience, helping to classify nurses into experience brackets, which may reflect their level of expertise and knowledge regarding MDRPIs.

F. Most Recently Graduated Nursing Program: Diploma, Bachelor's Degree or Postgraduate Degree: this question determines the nurse's highest level of completed education, which can impact their knowledge and approach to care, including MDRPIs.

G. Department Currently Worked In: Internal Services Medical intensive care units (MICU), surgical intensive care unit (SICU), Pediatric intensive care unit (PICU) or Cardiac care units (CCU). Here, nurses are asked about the department they work in. The department type can affect the frequency of exposure to MDRPIs, with more specialized departments likely encountering them more often.

H. Position in the Department: This item seeks to classify the nurse's position within the department. It helps identify their level of responsibility and leadership within the unit, which may influence their knowledge and approach to patient care, including prevention and management of MDRPIs.

- **Section 2: Professional Qualifications and Training**

This section collects information about the nurse's work background, previous training, and opinions on MDRPI treatment and prevention. Nurses answer based on their knowledge and views on these topics.

A. Have you ever attended a course on pressure injuries caused by medical devices? In order to assess the nurse's readiness and capacity to prevent and treat these injuries, it is crucial to know if they have received formal training on MDRPIs.

B. Information Sources about MDRPIs: This question enables the nurse to identify the formal training, courses, seminars, and other media that they have used to learn about MDRPIs.

C. Was the MDRPI training beneficial? This item evaluates the nurse's perception of the training's efficacy and offers information on how much of an influence it had on their practice.

D. Frequency of Encountering a Patient with MDRPIs: This section assesses the nurse’s exposure to patients with MDRPIs, which is important for understanding how familiar they are with the issue.

E. Information Sources about the Prevention/Treatment of MDRPIs: This question identifies where nurses gain their knowledge about preventing and treating MDRPIs, helping to understand the influence of various learning sources on their practice.

F. Do you think that prevention/treatment of MDRPIs should be assumed by nurses? This item explores the nurse’s view on whether they believe the responsibility for preventing and treating MDRPIs falls within their scope of practice.

G. Is it possible to prevent MDRPIs with good nursing care? This question assesses the nurse's belief in the effectiveness of proper nursing care as a preventive measure for MDRPIs.

H. Are your nursing practices for the prevention/treatment of MDRPIs sufficient? This question assesses the nurse's self-perception of their adequacy in preventing and treating MDRPIs.

I. Is a nursing care protocol necessary for the prevention of MDRPIs? This item asks whether the nurse believes formal protocols or guidelines are necessary to effectively prevent MDRPIs.

J. Do you think you have sufficient information about MDRPIs? This item helps assess the nurse’s perceived level of knowledge about MDRPIs, identifying possible knowledge gaps.

K. Would you be willing to participate in training on MDRPIs? This final item tests the nurse’s willingness to engage in further training, which can help tailor educational interventions to improve knowledge and practice around MDRPIs.

2) **Part B: MDRPI-KQ**

- **Development and Validation of the MDRPI-KQ: Expert Review and Content Validity**

The researchers reviewed existing literature and studies about MDRPIs in nursing practice. This ensured the research tool was based on solid scientific evidence (Sönmez & Bahar, 2022). The researchers also consulted with clinical nurses to gain practical insights about this topic. The MDRPI-KQ scale was then developed with 36 items covering different aspects of pressure injuries caused by medical devices, using established methods from the literature (Sönmez & Bahar, 2022).

Later, it was sent to seven experts. These experts are nursing professors, ICU nurses with long experience, and wound care specialists. All these experts had knowledge about managing pressure injuries. The questionnaire was given to this panel to check if the questions were clear and related to the research goal. This also tested content validity to make sure the scale measured what it was supposed to measure (Sönmez & Bahar, 2022).

Based on expert feedback, a content validity index (CVI) was calculated for each question in the scale. All values were above 0.80, showing high agreement that the items were suitable. The overall CVI for the entire scale was 0.99, which shows the measurement tool is very reliable (Sönmez & Bahar, 2022). Also, Kendall's W analysis was done to measure how much the experts agreed with each other. The W value was 0.271; $p = 0.041$. Kendall's W ranges from 0 to 1, with zero representing a complete lack of agreement and one indicating complete agreement. The results of the analysis revealed a moderate level of agreement between the experts' ratings regarding the scale's content (Sönmez & Bahar, 2022).

- **Structure and Composition of the MDRPI-KQ: Dimensions and Item Breakdown**

The MDRPI-KQ is composed of 36 statements organized into four main dimensions:

1. **Description:** 9 items
2. **Risk Factors:** 8 items

3. **Staging:** 3 items

4. **Prevention and Treatment:** 16 items

MDRPI-KQ Dimensions and Item Distribution (See the table in appendix A_4)

- **Scoring System and Interpretation of the MDRPI-KQ**

Among these statements, 20 are affirmative, while 16 are negative. Each statement is designed to assess nurses' knowledge regarding MDRPIs and can be answered as "true," "false," or "no idea (Sönmez & Bahar, 2022).

One point was assigned for each correct answer within the questionnaire items. No points were awarded for answers that fell within the incorrect answer category or the 'I have no idea' option, both of which were scored zero. Accordingly, the total score a participant could obtain in this questionnaire ranged from a minimum of 0 to a maximum of 36 points, proportional to the total number of items included in the instrument. The higher overall average scores obtained by the nurses are a positive indicator reflecting their improved level of knowledge about the concept of medical device-related pressure injuries (MDRPIs) (Sönmez & Bahar, 2022).

As for the method for calculating the percentage of correct answers, a simple equation was adopted. This equation consists of adding the total number of correct answers provided by the participant, dividing this result by the total number of questions included in the scale, and finally multiplying the result by 100 to convert it to a clear percentage value reflecting the level of knowledge acquired. A percentage of 70% (equivalent to 25.2 points out of 36) was set as the standard. To succeed in this test, the participant is considered to have achieved a passing score if he or she exceeds or reaches this threshold. In contrast, scores that fall below this level are an indication of the need for further cognitive enhancement(Sönmez & Bahar, 2022).

- **Scoring Assessment Levels Based on Correct Answer Percentages (Sönmez & Bahar, 2022) (See the table in appendix A_5)**

This combined approach enables a comprehensive evaluation of both the demographic and professional backgrounds of nurses, as well as their understanding and management of MDRPIs (See Appendix C).

2.6 Presentation of ethical consideration

1. Ethical approval was obtained from the institution review board (IRB) (16th February 2025 & Fsg/Med.Feb.2025/53) at An-Najah National University, as well as permissions from the Medical Research and Ethics Committee of the Ministry of Health in Palestine and the managers of the hospitals included in this study, detailed supporting data and materials are included in Appendices (J-L)

2. The confidentiality of all study participants was assured by ensuring that no form of identification was required from participants or any markers to identify participants on the questionnaires.

3. Participation in the study was voluntary, with no coercion involved, and participants had the right to self-determination.

4. No rewards were given to the participants.

5. A written consent form was obtained from all participants, which is included in Appendix E.

6. Participants' protection rights were assured, and participants were informed that no harm or risks would be encountered during their participation in the study.

7. The identity of the participants was protected if the research was published.

2.7 Data Collection

The following steps were taken to complete the study:

1. Administrative process:

The Director of Nursing at An-Najah National University Hospital informed of the official approval of the study, which was obtained from the appropriate authorities at An-Najah National University's Faculty of Nursing.

2. Informed Consent

The nurses' informed written consent to participate in the study was obtained after the study's objective was explained and confidentiality was preserved.

3. Data Collection

Data was gathered from February to April 2025 over two months. The researcher started each interview by introducing herself and explaining the purpose and nature of the study. The study was conducted in three phases.

- **Pre-Education Program Phase**

An initial invitation to attend the training course was emailed to all nurse staff members. Special invitation cards were also designed to emphasize attendance at the educational program. These cards were distributed to the heads of departments in various intensive care units, who placed them in visible locations within the units to publicize the invitation and share it with their departmental communication what's up groups. Photos of the invitation cards are attached in Appendix M.

- **Education program- implementation phase**

The educational training program was conducted over one full day, lasting approximately six hours. To accommodate nurses' varying schedules and shift duties in critical care units, the nursing staff was divided into three separate groups, each consisting of 25 nurses. This division was also intended to ensure a better understanding of the training content by all participants and to avoid exceeding the internationally recommended number of attendees per training session. This helps maintain an optimal learning environment and facilitates interactive engagement. As a result, the training program was repeated three times on different dates: February 26th, March 12th, and March 17th, 2025.

At the beginning of each session, the researcher explained the purpose, goals, and what participants needed to do. This included signing an informed consent form through a QR code. Participants scanned the code with their phones and completed the digital consent form, which took about 10 minutes. During this introduction, participants could ask questions and many of them asked about the study's goals, how to participate, and ethical issues. The researcher answered these questions to make sure everyone understood and wanted to participate voluntarily. The QR code is in Appendix N. Each participant got a unique number from 1 to 74 to protect their privacy. No names or other personal information were collected because this numbering system kept participants anonymous. These numbers identified participants throughout the study. The numbers

had two main purposes: they kept each participant's identity private, and they helped match the before and after surveys to the same person so results could be compared accurately. This anonymization technique complied with ethical standards and safeguarded participant data, which is included in Appendix O while enabling privacy and tracking each participant's progress throughout the training program.

After giving their consent, participants were asked to fill out a pre-test questionnaire to gauge their baseline understanding of MDRPIs. The questionnaire was also made available using a QR code for convenience the questionnaire, which is attached in Appendix P, took the nurses 15 to 20 minutes to complete.

Each participant received paper sheets and pens. This ensured they had the supplies needed for the required tasks and surveys during the session.

The educational program content then began. The first part was an interactive PowerPoint presentation based on international standards like the EPUAP/NPIAP/PPPIA Clinical Practice Guidelines and recent research (Dallı & Girgin, 2024) about MDRPIs. The information was designed to fill knowledge gaps and matched the questionnaire topics. The session covered:

- Definition and Differentiation:

Define MDRPIs and explaine how they differ from pressure injuries.

- Risk Factors:

Identifying the risk factors that increase the likelihood of MDRPIs.

- Staging of MDRPIs:

Explain the staging of MDRPIs.

- Evidence-Based Prevention and Management Strategies:

Providing evidence-based strategies for preventing and managing MDRPIs, including proper use of medical devices, repositioning techniques, and skin care interventions.

The presentation was designed to be engaging. The participants asked questions, made comments, and discussed cases. After the first part, there was a 30-minute breakfast break from 11:00 am to 11:30 am for relaxation and refreshments. The session

continued with the second part of the PowerPoint presentation. Then, participants reviewed a professional educational poster from an American journal. This poster showed different types of medical devices and how to prevent pressure injuries from each one. Copies of these posters were planned for each department to remind staff about prevention. The poster was based on "Evidence-based practice: Medical device-related pressure injury prevention" (Camacho-Del Rio & MBA-HM, 2018). A sample is in Appendix H.

All participants received a summary brochure to help them remember what they learned. This brochure gives clear, practical instructions on preventing MDRPIs in hospitals. It was also based on the same research (Camacho-Del Rio & MBA-HM, 2018) and is included in Appendix G.

The session ended with a question-and-answer discussion. Nurses could ask questions, get clarification, and share their experiences with MDRPIs. This interactive part helped improve understanding and engagement.

The Education Program:

Program Overview:

A. Purpose:

This program aims to teach nursing staff how to recognize, avoid, and treat pressure injuries related to medical devices (MDRPIs).

B. Objectives:

- To explain the aim of the study and its significance in preventing MDRPIs.
- To define MDRPIs and differentiate them from regular pressure injuries.
- To identify and discuss the risk factors contributing to the development of pressure injuries.
- To cover the principles of risk assessment related to pressure injuries.
- To identify the signs and symptoms of pressure injuries.
- To explain the pressure injury staging system and its clinical importance.

- To discuss the most common disorders and complications associated with pressure injuries.
- To explain preventive measures for device-related pressure injuries.
- To provide practical strategies for implementing prevention in clinical practice.
- To distribute a knowledge booklet and printed materials with guidelines and case scenarios to reinforce learning

In order to strengthen learning, a knowledge booklet and printed materials with instructions and case studies will be distributed.

C. Timeline:

- **Program Duration:** 8 hours in one day as a workshop.
- **Dates:** February 26th, March 12th, and March 17th, 2025.
- **Location:**
- **Venue:** An-Najah National University Hospital (NNUH) - Student Training Center.

D. Choose Delivery Methods and Resources:

- Appendix F contains the interactive PowerPoint presentation that will be used to deliver the training sessions. Included in the presentation will be:
- Visual Aids: Images and movies that highlight MDRPIs at various phases.
- Interactive Elements: Many interactive activities were used to improve participant involvement, including case study discussions and question-and-answer sessions in which nurses were asked to evaluate and resolve actual MDRPI-related situations. Participants were able to evaluate their comprehension of the subject matter and apply what they had learned.

Additionally, as a supportive method:

- **Concise Guidelines:** A set of concise guidelines based on the research "Evidence-based practice: Medical device-related pressure injury prevention" will be distributed to each nurse(Camacho-Del Rio & MBA-HM, 2018). The guidelines will also be included in the appendix G.

- **Posters:** Posters on the topic will be placed in each department to raise awareness and provide continuous visual reminders. These posters will be based on the same article(Camacho-Del Rio & MBA-HM, 2018) and included in Appendix H**.**

- **Post-education program phase:** To measure the effectiveness of the program, participants completed a pre-program questionnaire before the workshop and a post-program questionnaire after the workshop. The questionnaires assessed the nurses' knowledge of MDRPIs and their prevention strategies. To avoid data contamination, the post-test was administered only after the completion of the educational program for all participants, using the same methodologies, research team, and data collection tools—excluding the Nurse Characteristic Form. The post-test questionnaire was also provided electronically in the form of a QR code to facilitate easy access and completion, was attached in Appendix Q.

2.8 Data Analysis Plan

Quantitative data was analyzed using descriptive statistics in Statistical Package for Social Sciences (SPSS) version 22 to describe the distribution of variables used to summarize socio-demographic data, knowledge, and practice levels. The results are presented through pie charts, and tables.

- Paired samples t-test compared participants' practice scores and perceived barriers before the educational program and three months after.
- The one-way ANOVA examined differences in knowledge scores across demographic variables with three or more categories (age group, years of experience, clinical department, and job position).

- The independent samples t-test assessed knowledge score differences for demographic variables with two categories (gender, marital status, nursing education type, and prior training participation). This analysis approach helped identify significant patterns in the data and supported reliable interpretation of the study findings.

Chapter Three

Result

3.1 Introduction

This chapter is devoted to presenting the study results and analyzing the collected data systematically, in line with the research questions and hypotheses previously formulated to guide the study's progress and achieve its research objectives. A set of statistical methods appropriate to the nature of the data were adopted. Descriptive statistics were used as the special tool for data analysis, along with calculating arithmetic averages, with a focus on stating frequencies and percentages. It was done to provide a comprehensive and clear picture of the characteristics of the data extracted from the participants' answers. The number of individuals who participated in providing data was 'seventy-four", which provided the researchers with a sufficient database to study general patterns and analyze trends related to the study topic in a precise and organized scientific way.

3.2 Data Analysis

The final sample consisted of 74 individuals. The correct answers in the knowledge scale were recoded to 1, and the incorrect answers to 0, and the total knowledge was computed for each respondent by summing the answers and then converting the total knowledge to percentages by dividing the sum by the total number of items, which is 36. The same procedures were used to compute the total scale of the sub-knowledge parts (Knowledge Items, Risk Factors, Staging, and Prevention and Treatment).

3.3 Statistical Methods

Data analysis in this study was conducted using the Statistical Package for Social Sciences (SPSS), Version 22. A range of descriptive statistical techniques was employed, including frequencies, percentages, means, and standard deviations, with the purpose of summarizing and presenting the socio-demographic and personal characteristics of the participants, as well as describing the levels of the study variables both before and after the implementation of the educational program. Additionally, Cronbach’s alpha coefficients were calculated to assess the internal consistency and reliability of the items included in each of the employed measurement scales, ensuring that the instruments used provided consistent and dependable data for analysis.

To answer the research questions and test the study hypotheses, several statistical tests were used with a significance level of $p \leq 0.05$. The paired samples t-test compared participants' practice scores and perceived barriers before the educational program and three months after. The one-way ANOVA examined differences in knowledge scores across demographic variables with three or more categories (age group, years of experience, clinical department, and job position). The independent samples t-test assessed knowledge score differences for demographic variables with two categories (gender, marital status, nursing education type, and prior training participation). This analysis approach helped identify significant patterns in the data and supported reliable interpretation of the study findings.

3.4 Validity and Reliability of the Questionnaire

The researcher sent the questionnaire to nursing and health education experts. These experts reviewed the content and provided feedback on question clarity, topic relevance, and research goal alignment. The researcher then revised the questionnaire based on this feedback. This made it a good tool for measuring how well the educational program improved ICU nurses' knowledge about preventing MDRPIs in Palestinian hospitals.

To check the validity and accuracy of the tool, the researcher did a pilot study with 15 participants who met the study requirements. The researcher used Cronbach's alpha to measure internal consistency. The analysis results showed that the Cronbach's alpha coefficient for all 36 items was 0.76, a value that falls within the scientifically accepta le range. It indicates that the measurement tool used has a high degree ofb reliability and internal consistency, which enhances the credibility of the results that will be obtained from applying the questionnaire in the primary study.

3.5 Normality Test of the Study Variables

The normal distribution test was performed for the study variables in order to select between the parametric and the non-parametric methods for data analysis. The results of the tests of normality and the skewness coefficients are shown in test of Normality and the Skewness coefficients table in the appendix A6.

The results of normality tests (Kolmogorov-Smirnov and Shapiro-Wilk) in Table A6 show that most of the study variables are not normally distributed (P-values <0.05). On the other hand, most of the Skewness coefficients are less than 1, and since the sample

size is reasonable and large (more than 30), the researcher decided to use the parametric methods (ANOVA and T-test) in the study analysis.

3.6 Sociodemographic Characteristics & Professional Qualifications and Training

The study population included all nurses working in the various intensive care units of An-Najah National University Hospital, located in the West Bank, Palestine. These nurses were selected as the target group for this study because their experience and practice were directly related to the study topic of preventing medical device-related pressure injuries (MDRPIs). The actual study sample consisted of 74 nurses working in these units, 46 of whom were male and 28 female, reflecting a relative overrepresentation of males in this specialty within the study environment. Regarding marital status, approximately 55% of the sample were married, which may reflect the diverse living and social circumstances of the participants.

Regarding the age profile of the participating nurses, the results revealed that the 26-30 age group was the most represented within the sample, representing approximately 57%, indicating that the majority of the sample was young and still in the early to mid-career stages. The results also showed that 55.4% of the sample had between 3 and 5 years of nursing experience, reinforcing the hypothesis that they possess a good amount of practical experience related to practicing nursing in intensive care units. About 78% of the nurses had bachelor's degrees in nursing. This shows that the study participants had good education levels. So, the findings are more reliable.

The nurses worked in different units at An-Najah National University Hospital. 28.4% worked in the Medical ICU, 27% in the Surgical ICU, 25.7% in the Cardiac Care Unit, and 18.9% in the Pediatric ICU. Having nurses from different speciality units made the study results more complete.

Regarding job titles, it was found that more than half of the participants (52.7%) hold Registered Nurse (RN) positions, while 41.9% of them hold Senior RN positions, while a smaller percentage (5.4%) of the sample members hold Head Nurse positions. The attached table shows the detailed distribution of the study sample according to socio-demographic and personal characteristics in detail, which provides a comprehensive background on the sample's characteristics and contributes to the accurate scientific interpretation and analysis of the study results (see the table A7 in appendix A)

Sociodemographic Characteristics Distribution via Pie Chart (see appendix B)

The distribution of the study sample according to the professional qualifications and training (see The Table 8 in appendix A)

The study sample consisted of 41 nurses who received training on MDRPIs (55.4%), and the majority of them answered that the training on MDRPIs was helpful, and most of these 41 nurses have information about MDRPIs from courses and conferences (29.3% and 39%). The nurses frequently or sometimes encounter patients with MDRPIs (86.4%). The information sources about the Prevention/Treatment of MDRPIs for the nurses are 20.3% from Journals/Books on the Subject, 18.9% from the knowledge acquired during Nursing Education, 10.8% from co-working with experienced nurses, only 4.1% and 1.4% from Internet, Newspapers, or TV and Suggestions/Guidance of the Physician, and mostly from the other sources (44.6%). Most nurses think that prevention/treatment of MDRPIs should be assumed by nurses (97.3%), and most believe it is possible to prevent MDRPIs with good nursing care (95.9%). In addition, most nurses believe that their nursing practices for the prevention/treatment of MDRPIs are sufficient (75.7%), and most nurses believe that nursing care protocol is necessary to prevent MDRPIs (97.3%). Finally, most nurses believe they have sufficient information about MDRPIs (62.2%), and all the nurses in the sample answered that they would be willing to participate in training on MDRPIs.

Figure 2

Have you ever received training on medical device-related pressure injuries?

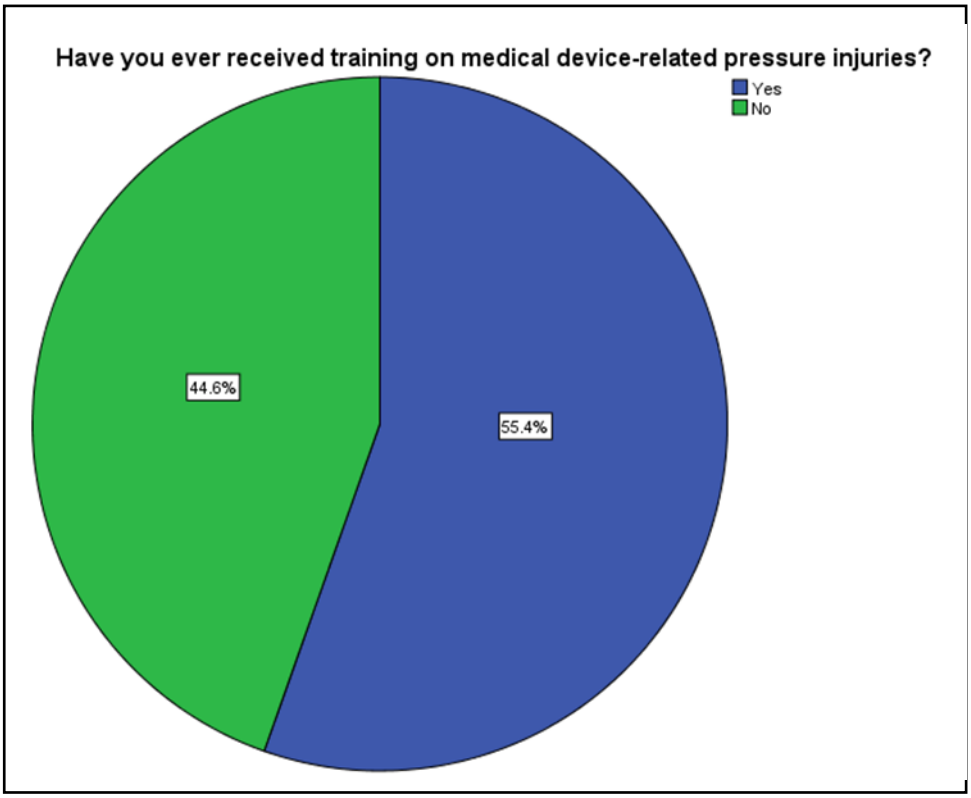


Figure 3

Information Sources about MDRPIs

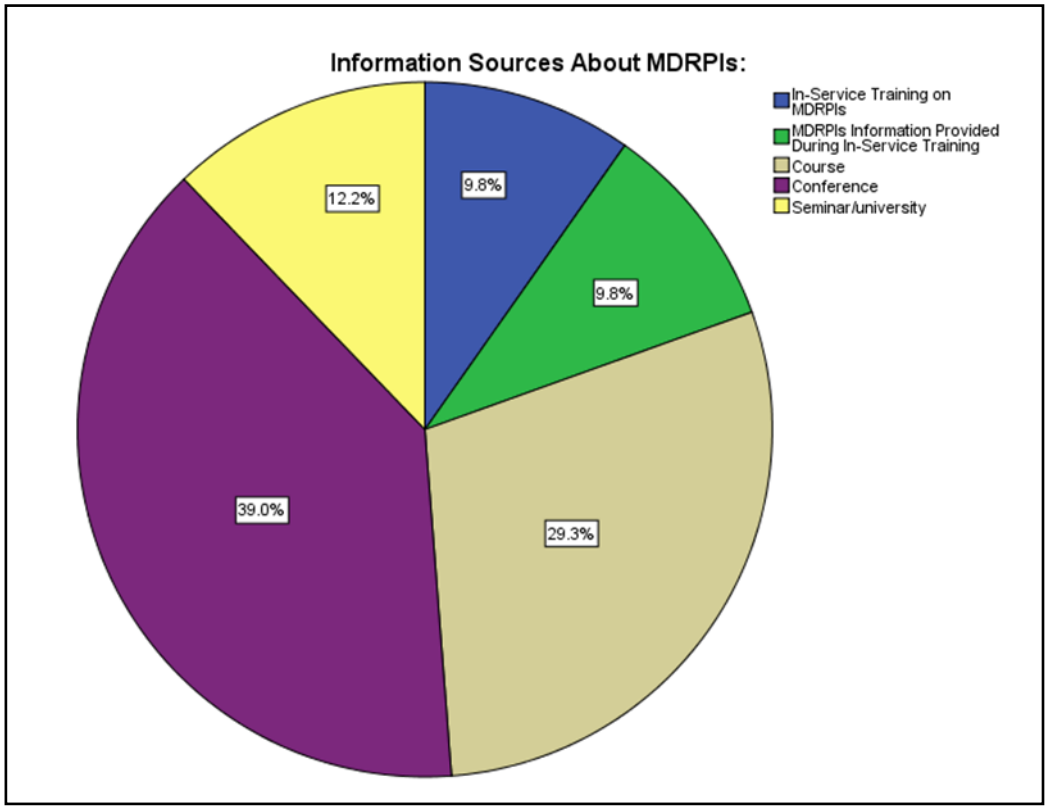


Figure 4

Was the training on MDRPIs helpful?

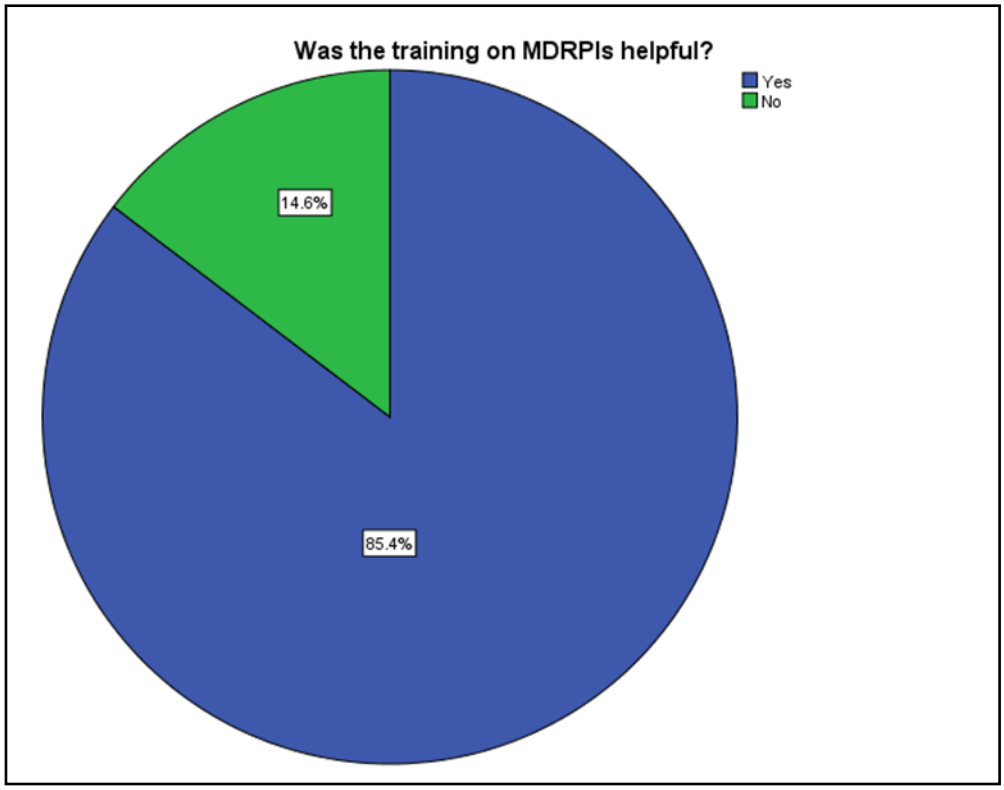


Figure 5

Frequency of Encountering a Patient with MDRPIs

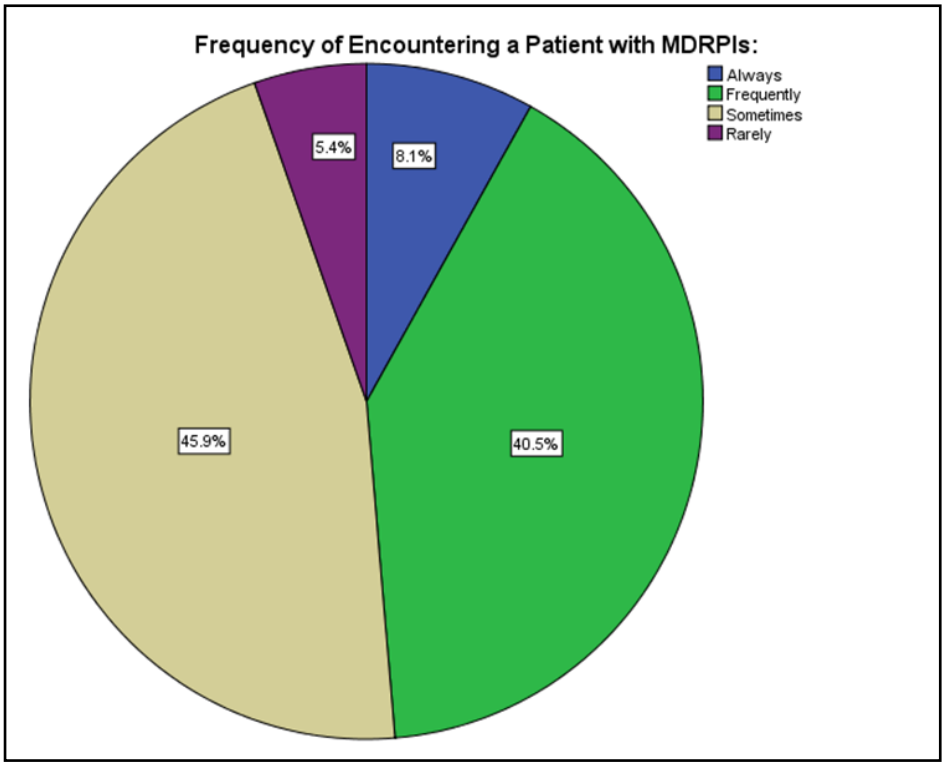


Figure 6

Information Sources about the Prevention/Treatment of MDRPIs

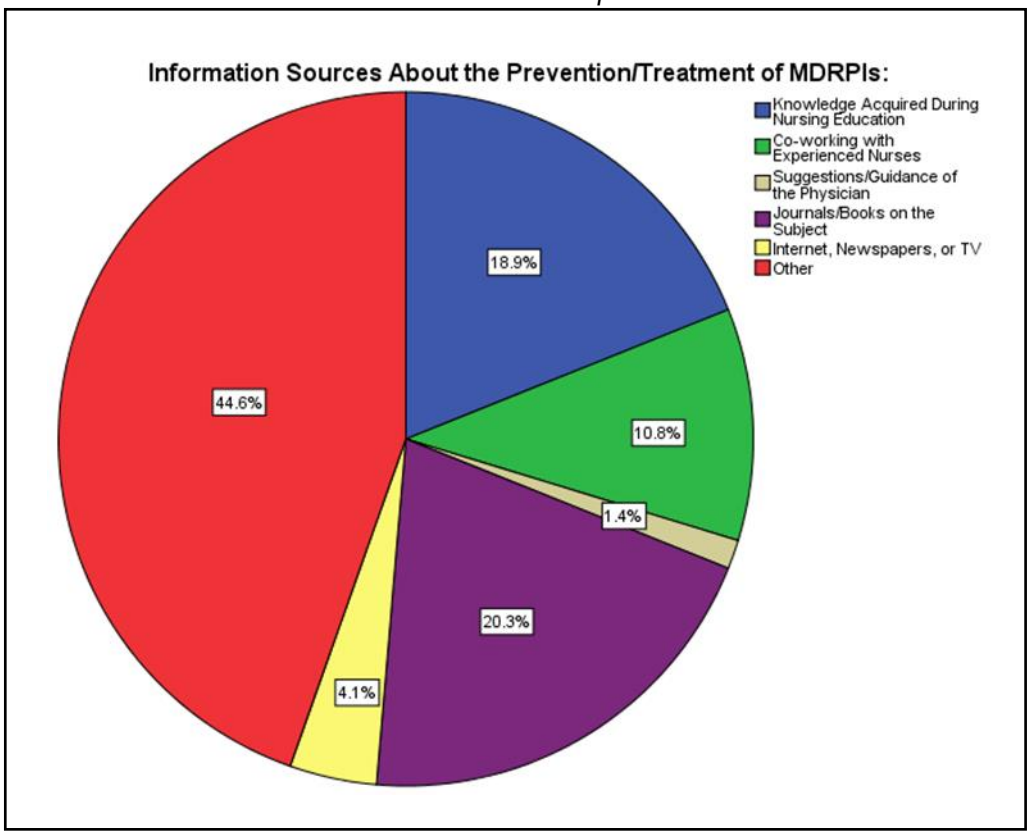


Figure 7

Do you think that prevention/treatment of MDRPIs should be assumed by nurses?

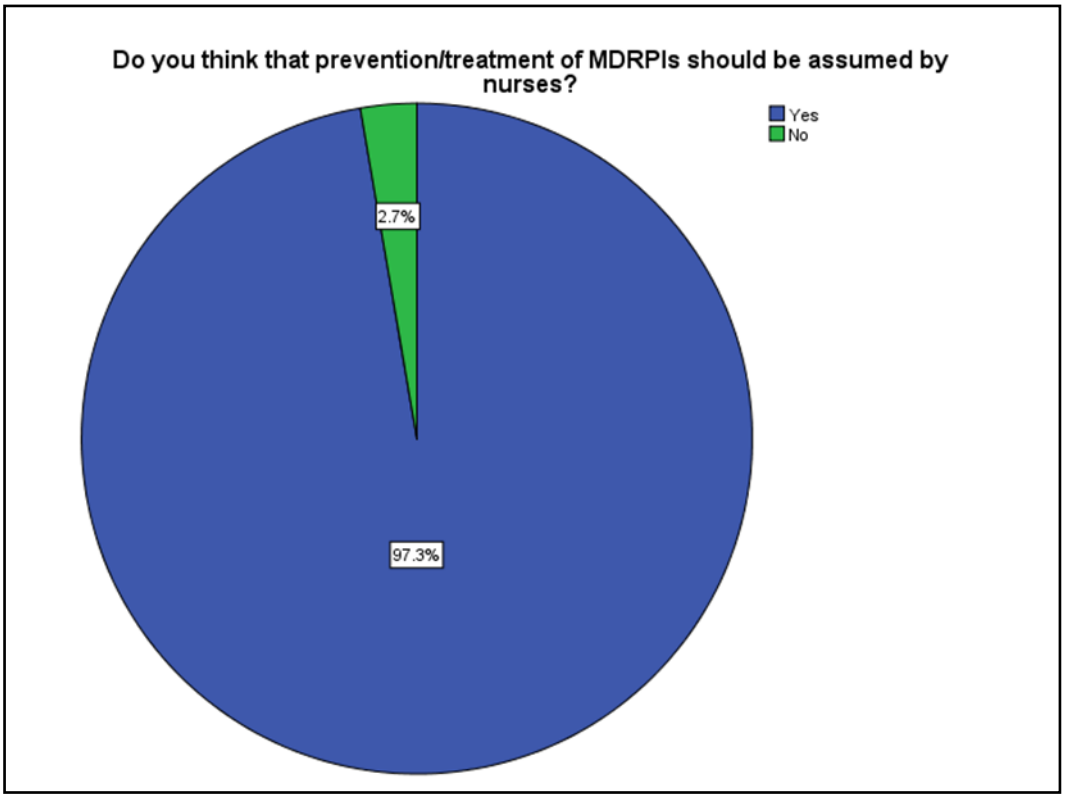


Figure 8

Is it possible to prevent MDRPIs with good nursing care?

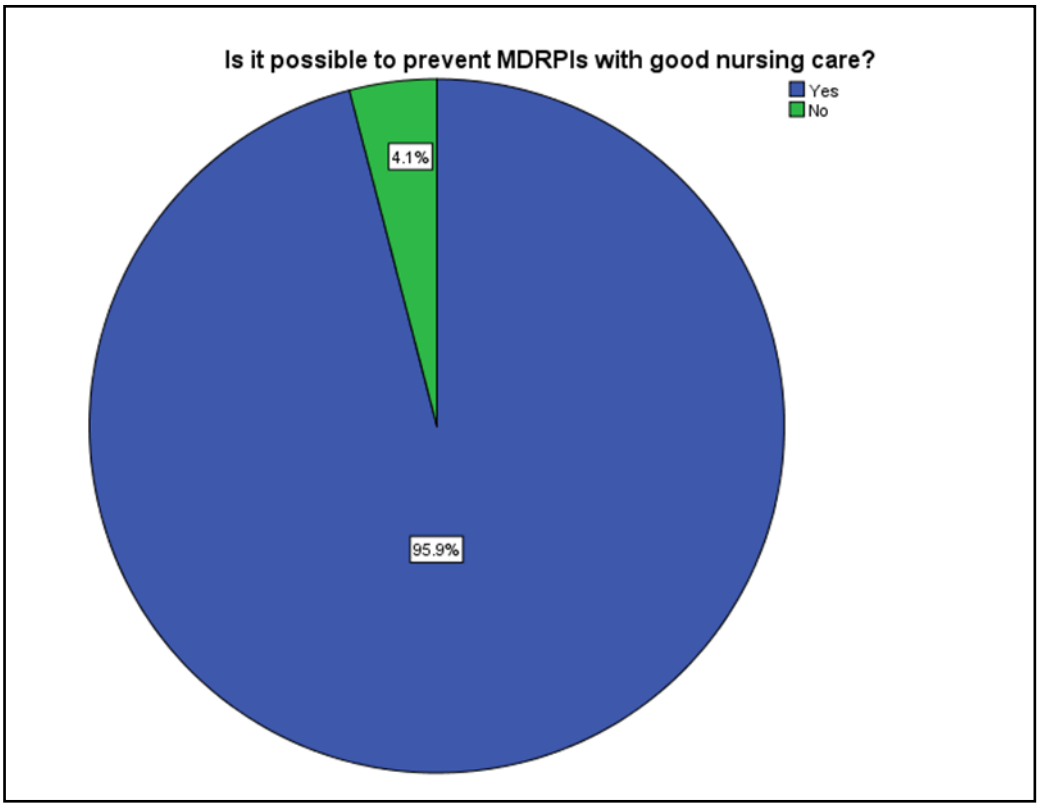


Figure 9

Are your nursing practices for the prevention/treatment of MDRPIs sufficient?

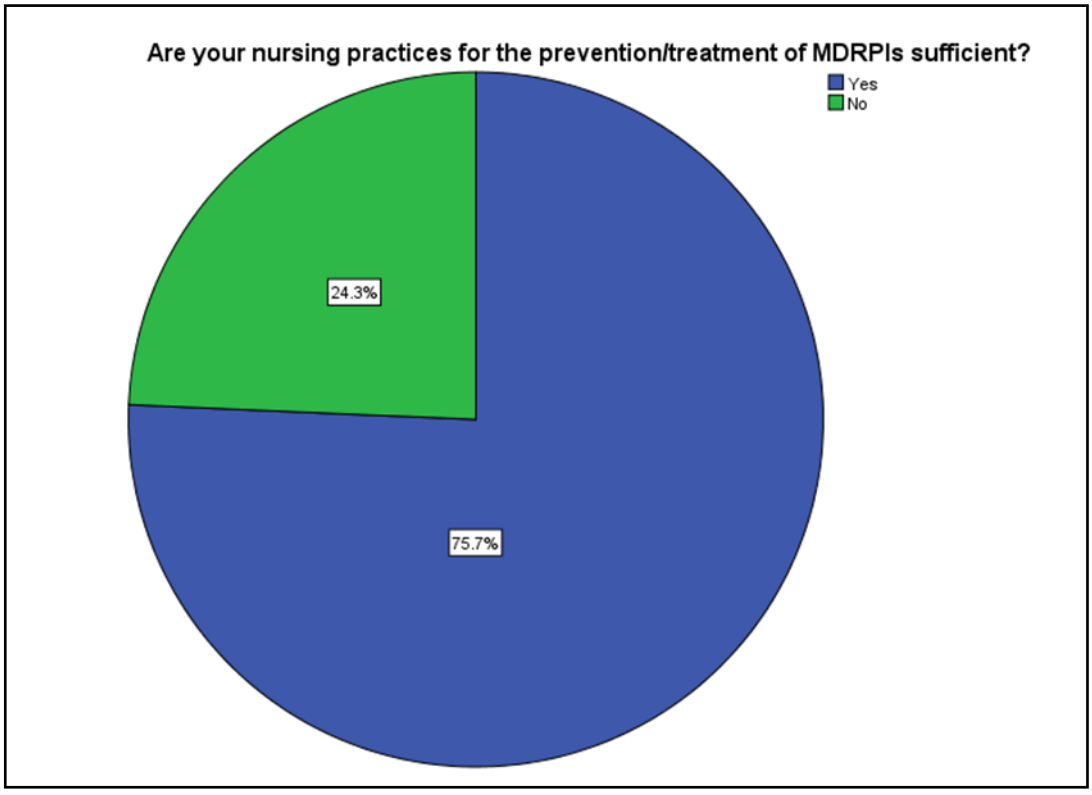
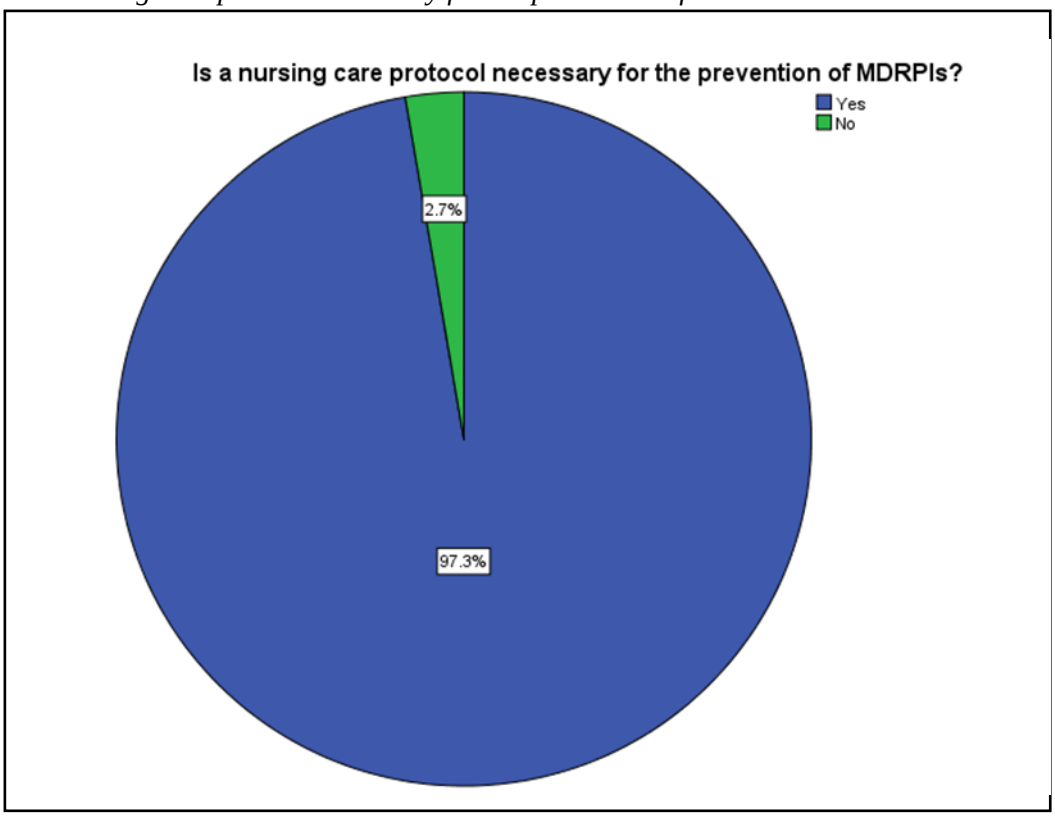


Figure 10

Is a nursing care protocol necessary for the prevention of MDRPIs?



Do you think you have sufficient information about MDRPIs? (Show it in Appendix B_8)

3.7 Research Questions

In this section, the researcher introduces the analysis of the study questions based on the study sampling answers:

3.7.1 Q1) what are the levels of nurses' knowledge regarding MDRPIs pre and post-the educational program?

To answer this question, the researcher computed frequencies and percentages of the correct answers of the nurses toward the items regarding MDRPIs pre and post-educational program, and the following table nine shows the results:

Table 1

Frequencies and percentages of the nurses' answers regarding MDRPIs Knowledge items.

Items	Pre		Post	
	N	%	N	%
1. 'MDRPIs are pressure injuries caused by medical devices and equipment.'	74	100.0%	74	100.0%
2. "MDRPIs are caused by constant pressure or friction due to medical devices."	65	87.8%	74	100.0%
3. 'MDRPIs constitute approximately 1/3 of all pressure injuries that may occur in the hospital environment.'	40	54.1%	71	95.9%
4. 'In MDRPIs, the tissue around or under the device and equipment takes the shape of the device.'	60	81.1%	73	98.6%
5. "The source of pressure in MDRPIs is the medical device itself."	56	75.7%	70	94.6%
6. "MDRPIs usually occur in areas with bony prominences."	29	39.2%	65	87.8%
7. "MDRPIs are simple wounds and do not cause serious complications."	46	62.2%	70	94.6%
8. 'MDRPIs are most common in the sacrum.'	40	54.1%	66	89.2%
9. "There are no differences in the appearance of general pressure injuries and MDRPIs."	44	59.5%	69	93.2%
Total (Average) knowledge	68.2%		94.9%	

The results shown in Table (1) showed that nurses' level of knowledge regarding medical device-related pressure complications (MDRPIs) before the educational program was 68.2%. At the same time, this percentage increased significantly after the program, reaching 94.9%. These results reflect the significant positive impact of the educational program in enhancing the knowledge level of the nurses participating in the study, confirming the effectiveness of the educational intervention in achieving its desired objectives.

Furthermore, the results showed a clear improvement in nurses' knowledge of all knowledge items related to the study topic after completing the educational program. For example, the percentage of nurses who correctly answered the statement "MDRPIs constitute approximately one-third of all pressure injuries that may occur in the hospital environment" increased from 54.1% before the program to 95.9% after the program, reflecting an increased awareness of the magnitude and importance of the problem in the clinical setting. Knowledge about MDRPI rates in areas with bone spurs improved from 39.2% to 87.8%. This shows that nurses need special training on body parts that are more at risk. Similarly, nurses' knowledge that the sacrum is among the most

susceptible areas for these injuries increased from 54.1% to 89.2% after implementing the educational program.

Taken together, these results indicate that the educational program was highly effective in bridging knowledge gaps among nurses and enhancing their awareness of the importance of preventing pressure-related complications associated with medical devices in intensive care units. It, in turn, contributes to improving the quality of care provided to patients and reducing the incidence of these injuries in the clinical setting.

3.7.2 Q2) what are the levels of nurses' knowledge regarding risk factors related to MDRPIs pre and post-educational program?

To answer this question, the researcher computed frequencies and percentages of the correct answers of the nurses toward the risk factors items related to MDRPIs pre and post-educational program, and the following Table 2 shows the results:

Table 2

Frequencies and percentages of the nurses' answers toward Risk Factors items

Risk Factors Items	Pre		Post	
	N	%	N	%
10. "Hypertension is not a risk factor for MDRPIs."	55	74.3%	52	70.3%
11. "MDRPIs are potentially caused only by breathing apparatus and feeding tubes."	44	59.5%	65	87.8%
12. "Hypoalbuminemia and malnutrition are not causes of MDRPIs."	53	71.6%	62	83.8%
13. "All patients with a medical device are at risk for MDRPIs."	58	78.4%	69	93.2%
14. 'Patients with signs of localized and generalized edema have a higher risk of MDRPIs.'	67	90.5%	72	97.3%
15. "Patients with swallowing problems are at risk of MDRPIs."	52	70.3%	70	94.6%
16. "Face masks used for non-invasive positive pressure ventilation (NIPPV) do not cause MDRPIs."	49	66.2%	69	93.2%
17. "Commonly used risk assessment scales do not assess the risk associated with MDRPIs."	51	68.9%	64	86.5%
Total (Average) knowledge	72.5%		88.3%	

The results also showed that the improvement in knowledge included most items on the risk factors related to MDRPIs, confirming the comprehensive effect of the educational program in covering different theoretical aspects related to the research problem. For example, the percentage of nurses who recognized the mistaken belief that "MDRPIs

are likely to be caused only by respirators and feeding tubes" increased from 59.5% before the educational program to 87.8% after the educational program, reflecting the effective correction of misconceptions related to the sources of injury. Likewise, the level of knowledge regarding the item "Non-invasive positive pressure ventilation (NIPPV) face masks do not cause MDRPIs" increased from 66.2% to 93.2%, indicating increased awareness of the risks inherent in the use of various medical devices, even those that may appear safe.

Together, these findings highlight the importance of targeted educational interventions to correct misconceptions and expand nurses' awareness of the various sources of risk connected with pressure injuries, which directly contributes to improving prevention practices and reducing the incidence of these injuries in intensive care settings.

3.7.3 Q3) what are the nurses' staging-related knowledge levels regarding MDRPIs pre and post-the educational program?

To answer this question, the researcher computed frequencies and percentages of the correct answers of the nurses toward the staging items regarding MDRPIs pre and post-educational program, and the following Table 3 shows the results:

Table 3

Frequencies and percentages of the nurses' answers toward staging items

Staging Items	Pre		Post	
	N	%	N	%
18. "The most common stage of encountering a MDRPI is stage 2."	51	68.9%	70	94.6%
19. "If the medical device causes a pressure injury on the mucosa, staging is achieved using the "International Pressure Ulcer Classification System."	19	25.7%	61	82.4%
20. "If the medical device causes a pressure injury on the skin, no staging is required."	49	66.2%	69	93.2%
Total (Average) knowledge	53.6%		90.1%	

The results shown in Table (3) showed that nurses' level of knowledge of the classification of medical device-induced pressure injuries (MDRPIs) improved significantly. This level reached 53.6% before the educational program and increased to 90.1% after the program. This significant increase reflects the positive impact of the educational program in enhancing nurses' scientific and accurate understanding of the

MDRPI classification criteria, a critical aspect in ensuring the provision of sound knowledge-based nursing care.

The results also indicate that the improvement extended to all classification elements without exception, demonstrating the effectiveness and comprehensiveness of the program's content. For example, nurses' knowledge of the item related to "the necessity of using the International Pressure Ulcer Classification System when a medical device causes a mucosal pressure injury" increased from 25.7% before the program to 82.4% after the program, reflecting a clear remediation of a previous knowledge gap in this vital aspect of injury classification. Furthermore, knowledge of the item stating, "If a medical device causes a skin pressure injury, no classification is required," increased from 66.2% to 93.2%, reflecting a clear correction of misconceptions regarding classification mechanisms. Additionally, knowledge of the item stating "The most common stage encountered in MDRPI is Stage II" increased from 68.9% to 94.6%, indicating a more accurate and professional enhancement of nurses' ability to differentiate between the different stages of injury.

These results demonstrate that the educational program was not merely a means of conveying information but rather an effective educational intervention that contributed to building nurses' substantive specialized knowledge, particularly regarding classification, which is a fundamental pillar in the diagnosis, prevention, and treatment of pressure injuries resulting from medical devices in critical care settings.

3.7.4 Q4) What are the levels of nurses’ prevention and treatment knowledge regarding MDRPIs pre and post-educational programs?

To answer this question, the researcher computed frequencies and percentages of the correct answers of the nurses toward the prevention and treatment items regarding MDRPIs pre- and post-educational program, and the following Table 4 shows the results:

Table 4

Frequencies and percentages of the nurses' answers toward Prevention and Treatment items

Prevention and Treatment Items	Pre		Post	
	N	%	N	%
21. "Placing the medical device or equipment under the immobile patient should be avoided."	68	91.9%	68	91.9%
22. "MDRPIs do not require any treatment and heal spontaneously."	46	62.2%	67	90.5%
23. "The skin around and under medical devices or equipment should be observed every 48–72 hours for signs of injuries."	19	25.7%	57	77.0%
24. "If the patient is at risk of oedema or exhibits signs of oedema, skin assessment should be performed more frequently than usual."	59	79.7%	71	95.9%
25. "Medical devices, except for the endotracheal tube, should be relocated periodically to redistribute pressure."	22	29.7%	47	63.5%
26. "Medical devices and equipment should be removed from the part of the body they are attached to as soon as medically possible."	72	97.3%	71	95.9%
27. "Relocating the medical devices at regular intervals is the most important preventive method to prevent MDRPIs."	69	93.2%	72	97.3%
28. "The skin surface in the area where the medical device is located should be massaged to prevent MDRPIs."	38	51.4%	55	74.3%
29. "If the dietary plan of adult patients at risk of MDRPIs does not meet nutritional requirements, a protein-rich nutritional supplement should be recommended."	70	94.6%	72	97.3%
30. "Using medical devices in a way that minimizes skin damage (soft material, etc.) reduces the risk of injury formation."	68	91.9%	70	94.6%
31. "Medical devices and equipment should be firmly fixed to avoid the risk of dislocation."	26	35.1%	52	70.3%
32. "The medical device should be placed directly on the skin."	33	44.6%	69	93.2%
33. "The skin on which medical devices are worn should be regularly moistened with moisturizing products to prevent MDRPIs."	23	31.1%	61	82.4%
34. "The skin on which medical devices are worn should be kept clean and dry to prevent MDRPIs."	70	94.6%	70	94.6%
35. "Medical devices and equipment should be the appropriate size for the patient."	73	98.6%	73	98.6%
36. "To reduce the pressure associated with the medical device, a specific dressing/pad should be used under the devices."	73	98.6%	74	100.0%
Total (Average) knowledge	70.0%		88.6%	

The results in Table 4 above show that the nurses' prevention and treatment knowledge levels regarding MDRPIs were 70% pre-educational program and increased to 88.6% post-educational program. The results also show that the nurses' knowledge increased in most of the prevention and treatment items post-educational program. For example, the level of nurses' knowledge of the item (The skin around and under medical devices or equipment should be observed every 48–72 hours for signs of injuries) increased from 25.7% to 77%. The level of nurses' knowledge of the item (Medical devices, except for the endotracheal tube, should be relocated periodically to redistribute pressure) increased from 29.7% to 63.5%. The level of nurses' knowledge of the item (The skin on which medical devices are worn should be regularly moistened with moisturizing products to prevent MDRPIs) increased from 31.1% to 82.4%, and the level of nurses' knowledge of the item (Medical devices and equipment should be firmly fixed on to avoid the risk of dislocation) increased from 35.1% to 70.3%.

3.7.5 Q5) What are the nurses' knowledge levels regarding MDRPIs pre- and post-educational programs?

To answer this question, the researcher computed the means and the standard deviations of the total nurses' knowledge regarding MDRPIs pre- and post-educational program (the total average of all the correct answers toward all the 36 items in the questionnaire), and the following table 5 shows the results:

Table 5

Means and standard deviations of the total nurses' pre- and post-educational program knowledge

Domain	Pre	Post
	Mean ± SD	Mean ± SD
Total nurses' knowledge regarding MDRPIs	68.73 ± 11.04	90.24 ± 11.16

The results in Table 5 above show that the mean of the total nurses' knowledge regarding MDRPIs pre the educational program was (Mean=68.73), which increased the educational program to (Mean=90.24).

3.4 Study Hypotheses

In this section, the researcher introduces the analysis of testing the study hypotheses:

3.4.1 H_0 1) there is no statistically significant impact of the implementation of the educational program on improving nurses' knowledge regarding MDRPIs at the level of significance 0.05.

The researcher used the paired sample T-test to test the null hypothesis (H_0 1), and the following table 6 shows the results:

Table 6

Means, standard deviations, and the results of paired samples T-test of the differences in the nurses' knowledge pre and post-educational program

Variable	Pre	Post	T (P-value)
	Mean ± SD	Mean ± SD	
Total nurses' knowledge regarding MDRPIs	68.17 ± 20.26	94.89 ± 12.36	-10.279 (<0.001)

The results in Table 6 above show that the implementation of the educational program has a statistically significant impact on improving nurses' knowledge regarding MDRPIs at the significance level 0.05, and the p-value of the T-test is less than 0.001. The results show that the nurses' knowledge improved post-educational program, where the mean of the nurses' knowledge regarding MDRPIs post-educational program (Mean=94.89) is significantly higher than the mean pre-educational program (Mean=68.17). Based on these results, the null hypothesis H_0 1 can be rejected.

3.4.2 H_0 2) there is no statistically significant impact of the implementation of the educational program on improving nurses' knowledge regarding risk factors related to MDRPIs at the level of significance 0.05.

The researcher used the paired sample T-test to test the null hypothesis (H_0 2), and the following table shows the results.

Table 7

Means, standard deviations, and the results of paired samples T-test of the differences in the nurses' knowledge regarding risk factors pre- and post-educational program

Variable	Pre	Post	T (P-value)
	Mean ± SD	Mean ± SD	
Total nurses' knowledge regarding risk factors related to MDRPIs	72.47 ± 17.92	88.34 ± 14.68	-6.315 (<0.001)

The results in Table 7 above show that the implementation of the educational program has a statistically significant impact on improving nurses' knowledge regarding risk factors related to MDRPIs at the level of significance 0.05. The p-value of the T-test is less than 0.001. The results show that the nurses' knowledge regarding risk factors improved post-educational program, where the mean of the nurses' knowledge regarding risk factors related to MDRPIs post-educational program (Mean=88.34) is significantly higher than the mean pre-educational program (Mean=72.47). Based on these results, the null hypothesis H_0 2 can be rejected.

3.4.3 H_0 3) There is no statistically significant impact of the implementation of the educational program on improving nurses' staging-related knowledge regarding MDRPIs at the level of significance 0.05.

The researcher used the paired sample T-test to test the null hypothesis (H_0 3), and the following table shows the results:

Table 8

Means, standard deviations, and the results of paired samples T-test of the differences in the nurses' staging-related knowledge pre and post-educational program

Variable	Pre	Post	T (P-value)
	Mean ± SD	Mean ± SD	
Total nurses' staging-related knowledge regarding MDRPIs	53.6 ± 28.57	90.09 ± 20.44	-9.208 (<0.001)

The results in Table 8 above show that the implementation of the educational program has a statistically significant impact on improving nurses' staging-related knowledge regarding MDRPIs at the level of significance 0.05. The p-value of the T-test is less

than 0.001. The results show that the nurses' staging-related knowledge improved post-educational programs where the mean of the nurses' staging-related knowledge regarding MDRPIs post-educational program (Mean=90.09) is significantly higher than the mean pre-educational program (Mean=53.6). Based on these results, the null hypothesis H_0 3 can be rejected.

3.4.4 H_0 4) there is no statistically significant impact of the implementation of the educational program on improving nurses' prevention and treatment knowledge regarding MDRPIs at the level of significance 0.05

The researcher used the paired sample T-test to test the null hypothesis (H_0 4), and the following table shows the results:

Table 9

Means, standard deviations, and the results of paired samples T-test of the differences in the nurses' prevention and treatment knowledge pre and post-educational program

Variable	Pre	Post	T (P-value)
	Mean ± SD	Mean ± SD	
Total nurses' prevention and treatment knowledge regarding MDRPIs	70.02 ± 10.13	88.6 ± 12.77	-10.301 (<0.001)

The results in Table 9 above show that the implementation of the educational program has a statistically significant impact on improving nurses' prevention and treatment knowledge regarding MDRPIs at the significance level of 0.05. The p-value of the T-test is less than 0.001. The results show that the nurses' prevention and treatment knowledge improved post-educational program where the mean of the nurses' prevention and treatment knowledge regarding MDRPIs post-educational program (Mean=88.6) is significantly higher than the mean pre-educational program (Mean=70.02). Based on these results, the null hypothesis H_0 4 can be rejected.

3.4.5 H_0 5) there is no statistically significant impact of the implementation of the educational program on improving the total nurses' knowledge regarding MDRPIs at the level of significance 0.05

The researcher used the paired sample T-test to test the null hypothesis (H_0 5), and the following table shows the results:

Table 10

Means, standard deviations, and the results of paired samples T-test of the differences in the total nurses' knowledge pre and post-educational program

Variable	Pre	Post	T (P-value)
	Mean ± SD	Mean ± SD	
The total level of the nurses' knowledge regarding MDRPIs	68.73 ± 11.04	90.24 ± 11.16	-12.835 (<0.001)

The results in Table 10 above show that the implementation of the educational program has a statistically significant impact on improving the total nurses' knowledge regarding MDRPIs at the level of significance 0.05. The p-value of the T-test is less than 0.001. The results show that the total nurses' knowledge improved post-educational program, where the mean of the total nurses' knowledge regarding MDRPIs post-educational program (Mean=90.24) is significantly higher than the mean pre-educational program (Mean=68.73). Based on these results, the null hypothesis H_0 5 can be rejected.

3.4.6 H_0 6) there is no statistically significant differences at the level of 0.05 in the total level of the nurses' knowledge regarding MDRPIs post-educational program according to the demographic characteristics (Gender, Marital Status, Work of experience, Graduated Nursing Program, Department, Position, Training)

The researcher used The independent sample T-test and the one-way analysis of variance (ANOVA) in order to test the differences in the means of the total nurses' knowledge post-educational program according to the demographic variables, and the following table shows the results in appendix A9.

Means, standard deviations, and the results of T or ANOVA tests of the differences in the means of the total nurses' knowledge post-educational program according to the demographic variables, the dependent variable is the total nurses' knowledge post-educational program. (see the table 9 in appendix A)

The results in the table9 (see appendix A) that there are no statistically significant differences at the level of 0.05 in the total level of the nurses' knowledge regarding MDRPIs post-educational program according to the demographic characteristics (Gender, Marital Status, Work of experience, Graduated Nursing Program, Department, Position). The p-values of the F or T-tests are higher than 0.05 for these demographic variables; hence, the null hypothesis H_0 6 cannot be rejected regarding these variables.

On the other hand, the results show that there are statistically significant differences at the level of 0.05 in the total level of the nurses' knowledge regarding MDRPIs post-educational program according to the demographic characteristics (Age and Training). Regarding the age variable, the p-value of the F-test is 0.003, and the results of Tukey post-hoc pairwise comparisons (see the table 10 in Appendix A) show that the mean of the nurses' knowledge for the age group (31 years or more) (Mean=94.44) and the mean for the age group (26-30 years) (Mean=90.61) are significantly higher than the mean of the age group (22-25 years) (Mean=80.81). Regarding the training variable, the results show that the p-value of the T-test is 0.006, and the mean of knowledge for the nurses who have never received training on MDRPIs (Mean=93.94) is significantly higher than the mean of knowledge for the nurses who have ever received training on MDRPIs (Mean=87.26). Hence, the null hypothesis $H_0$6 can be rejected only regarding the variables Age and Training.

3.5 Summary of the Results

The statistical data analysis for this study indicated many results that are summarized based on the study questions and hypotheses as follows:

Study questions:

Q1) what are the levels of nurses' knowledge regarding MDRPIs pre- and post-educational program?

The results showed that the level of nurses' knowledge regarding MDRPIs was 68.2% pre-educational program and increased to 94.9% post-educational program. The results also showed that the nurses' knowledge of all the knowledge items regarding MDRPIs post-educational program increased. For example, the level of nurses' knowledge of the item (MDRPIs constitute approximately 1/3 of all pressure injuries that may occur in the hospital environment) increased from 54.1% to 95.9%. The level of nurses'

knowledge of the item (MDRPIs usually occur in areas with bony prominences) increased from 39.2% to 87.8%, and the level of nurses' knowledge of the item (MDRPIs are most common in the sacrum) increased from 54.1% to 89.2%.

Q2) what are the levels of nurses' knowledge regarding risk factors related to MDRPIs pre- and post-educational program?

The results showed that the levels of nurses' knowledge regarding risk factors related to MDRPIs was 72.5% pre-educational program and increased to 88.3% post-educational program. The results also showed that the nurses' knowledge increased approximately in all the risk factors items in the educational program. For example, the level of nurses' knowledge of the item (MDRPIs are potentially caused only by breathing apparatus and feeding tubes) increased from 59.5% to 87.8%, and the level of nurses' knowledge of the item (Face masks used for non-invasive positive pressure ventilation (NIPPV) do not cause MDRPIs) increased from 66.2% to 93.2%.

Q3) what are the nurses' staging-related knowledge levels regarding MDRPIs pre- and post-educational program?

The results showed that the levels of nurses' staging-related knowledge regarding MDRPIs was 53.6% pre-educational program and increased to 90.1% post-educational program. The results also showed that the nurses' knowledge increased in all the staging items post-educational program. The level of nurses' knowledge of the item (If the medical device causes a pressure injury on the mucosa, staging is achieved using the "International Pressure Ulcer Classification System") increased from 25.7% to 82.4%, and the level of nurses' knowledge toward the item (If the medical device causes a pressure injury on the skin, no staging is required) increased from 66.2% to 93.2%, and the level of nurses' knowledge toward the item (The most common stage of encountering a MDRPI is stage 2) increased from 68.9% to 94.6%.

Q4) what are the levels of nurses' prevention and treatment knowledge regarding MDRPIs pre- and post-educational programs?

The results showed that the levels of nurses' prevention and treatment knowledge regarding MDRPIs was 70% pre-educational program and increased to 88.6% post-educational program. The results also showed that the nurses' knowledge increased in most of the prevention and treatment items post-educational program. For example, the level of nurses' knowledge of the item (The skin around and under medical devices or equipment should be observed every 48–72 hours for signs of injuries) increased from 25.7% to 77%. The level of nurses' knowledge of the item (Medical devices, except for the endotracheal tube, should be relocated periodically to redistribute pressure) increased from 29.7% to 63.5%. The level of nurses' knowledge of the item (The skin on which medical devices are worn should be regularly moistened with moisturizing products to prevent MDRPIs) increased from 31.1% to 82.4%, and the level of nurses' knowledge of the item (Medical devices and equipment should be firmly fixed on to avoid the risk of dislocation) increased from 35.1% to 70.3%.

Q5) what are the total nurses' knowledge levels regarding MDRPIs pre- and post-educational program?

The results showed that the mean of the total nurses' knowledge regarding MDRPIs pre-educational program was (Mean=68.73), which increased post-educational program to (Mean=90.24).

Study Hypotheses:

H_0 1) There is no statistically significant impact of the implementation of the educational program on improving nurses' knowledge regarding MDRPIs at the level of significance 0.05.

The results showed a statistically significant impact of the implementation of the educational program on improving nurses' knowledge regarding MDRPIs at the significance level 0.05, the nurses' knowledge improved post-educational program, and the null hypothesis H_0 1 was rejected.

H_0 2) There is no statistically significant impact of the implementation of the educational program on improving nurses' knowledge regarding risk factors related to MDRPIs at the level of significance 0.05.

The results showed that there is a statistically significant impact of the implementation of the educational program on improving nurses' knowledge regarding risk factors related to MDRPIs at the level of significance 0.05, the nurses' knowledge regarding risk factors improved post-educational program, and the null hypothesis H_0 2 was rejected.

H_0 3) There is no statistically significant impact of the implementation of the educational program on improving nurses' staging-related knowledge regarding MDRPIs at the level of significance 0.05.

The results showed that there is a statistically significant impact of the implementation of the educational program on improving nurses' staging-related knowledge regarding MDRPIs at the level of significance 0.05, the nurses' staging-related knowledge improved post-educational program and the null hypothesis H_0 3 was rejected.

H_0 4) There is no statistically significant impact of the implementation of the educational program on improving nurses' prevention and treatment knowledge regarding MDRPIs at the level of significance 0.05.

The results showed that there is a statistically significant impact of the implementation of the educational program on improving nurses' prevention and treatment knowledge regarding MDRPIs at the level of significance 0.05, the nurses' prevention and treatment knowledge improved post-educational program and the null hypothesis H_0 4 was rejected.

H_0 5) There is no statistically significant impact of the implementation of the educational program on improving the total nurses' knowledge regarding MDRPIs at the level of significance 0.05.

The results showed that there is a statistically significant impact of the implementation of the educational program on improving the total nurses' knowledge regarding MDRPIs at the level of significance 0.05, the total nurses' knowledge improved post-educational program and the null hypothesis H_0 5 was rejected.

H_0 6) there are no statistically significant differences at the level of 0.05 in the total level of the nurses' knowledge regarding MDRPIs post-educational program according to the demographic characteristics (Gender, Marital Status, Work of experience, Graduated Nursing Program, Department, Position, and Training).

The results showed that there are no statistically significant differences at the level of 0.05 in the total level of the nurses' knowledge regarding MDRPIs post-educational program according to the demographic characteristics (Gender, Marital Status, Work of experience, Graduated Nursing Program, Department, Position), and the null hypothesis H_0 6 could not be rejected regarding these variables.

On the other hand, the results showed that there are statistically significant differences at the level of 0.05 in the total level of the nurses' knowledge regarding MDRPIs post-educational program according to the demographic characteristics (Age and Training), the nurses' knowledge for the age group (31 years or more) and for the age group (26-30 years) were significantly higher than that for the age group (22-25 years), and the knowledge for the nurses who have never received training on MDRPIs was significantly higher than the knowledge for the nurses who have ever received training on MDRPIs. The null hypothesis H_0 6 was rejected regarding only the variables Age, and Training.

Chapter Four

Discussion and Conclusion

4.1 Introduction

This chapter includes a comprehensive explanation and critical analysis of the study results in relation to the research questions and objectives. It interprets the findings in light of previous literature, highlights consistencies or contradictions with prior studies, and explains the possible reasons behind the observed outcomes. Additionally, this chapter presents the study's limitations, which may have influenced the results or the generalizability of the findings. It concludes with a clear summary of the key outcomes and provides practical recommendations for nursing practice, hospital policies, and future research.

4.2 Discussion

As medical devices are increasingly used for treatment and monitoring, MDRPIs have gained greater attention from healthcare professionals. MDRPIs are a major health concern because they affect patients' quality of life and impose significant costs on healthcare systems, patients, and families (Gefen et al., 2020).

However, since devices are essential to patient treatment and pressure injury risk assessment tools do not cover MDRPIs, healthcare professionals and nurses have low awareness about MDRPIs. As a result, MDRPIs are often not identified, poorly reported, or inadequately documented until they progress to severe forms such as Stage 3 or 4 (Barakat-Johnson et al., 2019; Lyu et al., 2023).

This requires regular updates to healthcare professionals' knowledge, especially nurses, about MDRPI prevention and treatment. Based on our observations, this was also the case in our ICUs. We found significant improvements in MDRPI development and ICU nurses' knowledge and prevention interventions after training.

Nurses play a key role in identifying patients at risk of MDRPIs and preventing these injuries. Healthcare quality improves as nurses' knowledge and practice increase. Therefore, it is essential to provide nurses with effective training, comprehensive knowledge, and current information about MDRPI prevention measures (Rashvand et al., 2020).

Therefore, this study aimed to evaluate the effectiveness of an educational program in improving ICU nurses' knowledge about preventing MDRPIs.

4.2.1 Sociodemographic Characteristics

- **Age of Nurses**

The majority of nurses in the study were between 26–30 years old (about 57%), representing the dominant age group. These findings align with (Sönmez & Bahar, 2022), who also reported that most ICU nurses were under 30 and (Sayed et al., 2022), who reported that most nurses were between 21 and 30 years old. However, they contradict the findings of previous work (Zhang et al., 2021; Dang et al., 2022), which observed that most nursing participants were over 30 years old, indicating potential regional or institutional differences in workforce demographics.

- **Gender of Nurses**

The study sample included more male nurses than female nurses (46 males vs 28 females). This finding contradicts recent work (Sayed et al., 2022; Yan et al., 2022), which reported that female nurses comprised most of their study samples. However, the current result aligns with reports that ICU units may attract more male nurses due to the nature of critical care work.

- **Work of experience**

Over half of the nurses (55.4%) had worked in clinical settings for three to five years. Since the majority were in their late twenties, this experience level is appropriate for their age group and suggests that they were early career professionals with a moderate amount of ICU exposure. These results match Sayed et al. (2022) and Yan et al. (2022). Their studies found that most nurses had less than five years of experience. But Lotfi et al. (2019) found different results. ICU nurses in their study had more than 14 years of experience. This shows that study groups and healthcare systems can vary.

Education Level of Nurses

Most nurses in this study had bachelor's degrees in nursing. So, it can be said that the sample was well-educated. Zhang et al. (2021) and Dang et al. (2022) found similar results where most ICU nurses had bachelor's degrees. However, Sayed et al. (2022)

found different results. The study concluded that most nurses had technical institute diplomas. Mohamed and Weheida (2015) also found that most ICU nurses had either secondary education or technical nursing diplomas.

4.2.2 Professional Qualifications and Training

- **Nurses' Training Status**

More than half of the nurses in this study had MDRPI training before. This is different from Sayed et al. (2022), who found that none of their nurses had any training on preventing pressure injuries from medical devices. They explained this outcome by claiming that there was a lack of finance and nursing personnel, which might have made it more difficult for people to take part in training courses.

- **Sources of Knowledge on MDRPIs**

While some nurses reported acquiring MDRPI knowledge through formal education, courses, or conferences, the majority relied on unspecified "other sources," possibly including informal or non-academic means. Despite this, nearly all participants expressed a strong willingness to receive formal training in the future, unlike the findings of Zhang et al. (2021) and Lotfi et al. (2019), where few participants received continuing education.

4.2.3 Knowledge regarding MDRPIs

- Knowledge Items:

The current study demonstrated a substantial improvement in nurses' knowledge regarding MDRPIs, increasing from 68.2% before the educational program to 94.9% after its implementation. Similarly, the study conducted by Sayed et al. (2022) and Mohamed and Weheida (2015) reported that nurses' knowledge scores increased immediately after a program's implementation with a statistically significant difference compared to pre-implementation of the education program.

- Nurses' knowledge of MDRPI risk factors:

The study found that nurses' understanding of MDRPI risk factors increased from 72.5% to 88.3% following the teaching session. This result confirms the findings of Zhang et al. (2021), who highlighted that targeted education increases nurses' knowledge of a range

of risk factors outside of their typical fields. On the other hand, despite receiving in-service training, nurses' understanding of MDRPI risk factors remained inadequate, according to Lotfi et al. (2019).

- Nurses’ knowledge regarding MDRPI staging:

The findings showed that nurses' understanding of MDRPI staging significantly improved, rising from 53.6% before the program to 90.1% after it. These results are consistent with those of Dallas and Girgin (2024), who discovered that training helped dispel misunderstandings about staging instructions. Similarly, after attending educational sessions, (Sayed et al., 2022) observed initial gains in staging knowledge. They did note a gradual deterioration in information retention, though, which points to the necessity of ongoing reinforcement via refresher training. Nurses’ knowledge regarding the prevention and treatment:

The educational intervention significantly improved nurses’ knowledge regarding the prevention and treatment of MDRPIs increasing from 70% pre-program to 88.6% post-program. These findings align with those of(Sönmez & Bahar, 2022), who reported that nurses’ knowledge levels in the prevention subscales were approximately moderate and emphasized that recognizing risk factors is the first essential step in preventing pressure injuries. In contrast, (Yan et al., 2022)found minimal improvement in prevention knowledge following training programs, which may be attributed to variations in program structure, quality of content, duration of intervention, or lack of clinical reinforcement. This highlights the importance of delivering comprehensive, practical, and context-relevant educational programs to achieve meaningful outcomes.

- Overall Knowledge Enhancement:

According to the results, nurses' knowledge of MDRPI staging increased dramatically, from 53.6% prior to the program to 90.1% following it. These findings are in line with those of Dallas and Girgin (2024), who found that training cleared up misconceptions regarding staging directions. Similarly, after attending educational sessions, initial improvements in staging knowledge were noted by (Sayed et al., 2022). However, they did observe a slow decline in memory, which suggests that continual reinforcement through refresher training is required. However, Zhang et al. (2021) demonstrated rather

strong staging knowledge even before their training session, indicating that institutional protocols and prior experience may also have an effect on baseline knowledge levels.

Similarly, the thorough and useful quality of the training offered may be responsible for the favourable outcomes seen in this study. This is further corroborated by a meta-analysis by Kim et al. (2019), which discovered that nurses' clinical knowledge and decision-making abilities about MDRPIs were considerably improved by mixed-method educational interventions longer than two hours.

Sayed et al. (2022) noted that although knowledge scores increased right after the intervention, they slightly decreased three weeks later, indicating the significance of further instruction and reinforcement.

Zhang et al. (2021) found that nurses had good MDRPI knowledge even without formal training programs. This difference might come from nurses having different clinical experiences and educational backgrounds or working in hospitals that focus more on pressure injury prevention.

4.3 Limitation

This study has a main limitation. The data was collected from a small sample in one hospital. So, the researcher believes that this sample size could limit the findings' applicability to larger populations or other clinical settings. Furthermore, because the course's influence on nurses' knowledge was only assessed after the training, its long-term effects are unknown. There was no specialized personnel available to deliver the educational program; therefore, it was explained by the researcher. Additionally, potential confounding variables that might have affected the results were carefully controlled during the study.

4.4 Conclusion

It was demonstrated that the MDRPI prevention and management training program was a successful instrument for raising nurses' awareness and knowledge of the problem while also equipping them with current, evidence-based techniques and expertise. The study's conclusions showed the value and necessity of giving nurses on-the-job training, particularly for MDRPIs, which are frequently disregarded in intensive care units.

Given their pivotal role in preventing MDRPIs, nurses must frequently refresh their expertise through training programs.

4.5 Recommendation:

4.5.1 Recommendations for Nurses:

- A checklist method should be used to assess patients in the intensive care unit such as skin colour, warmth, wetness, turgor, edema, and the existence of any skin injuries.
- Nurses should follow a standardized approach and protocols consistently to prevent MDRPIs.
- Based on the statistically significant improvement in nurses' knowledge post-education ($p < 0.001$), it is recommended that regular training programs be institutionalized in ICUs.
- Nurses should attend conferences, workshops, and seminars about MDRPI prevention and management to improve their skills and knowledge.

4.5.2 Recommendations for Nursing Management

- The head nurse should create a detailed plan to check that nursing staff use all parts of the care bundle correctly and follow best practices.
- There should be clear and consistent documentation of all MDRPI cases.
- Regular training programs should be institutionalized in ICUs to improve nurses' knowledge and skills.
- Participants reported lack of access to protective devices (e.g., foams, facial cushions), which could contribute to MDRPIs. Hence, ensuring availability of these materials is critical."

4.5.3 Recommendations for the Hospital

- ICUs should add a standard MDRPI prevention protocol to their regular procedures. This will ensure all staff use the same approach and reduce device-related pressure injuries.

- Given that 63% of nurses reported inconsistent documentation, integrating a structured skin integrity protocol into the CIS may standardize assessment and facilitate early detection of MDRPIs.
- The hospital needs a clear policy for reporting all MDRPI cases. This policy should ensure proper documentation, quality improvement, and monitoring.

4.5.4 Recommendations for Research

- More research should be conducted in different clinical settings and with larger sample sizes to expand knowledge in the area of pressure injury prevention.

List of Abbreviations

Abbreviation	Meaning
MDRPIs	Medical Device-Related Pressure Injury's
PU	Pressure Ulcers
PIs	Pressure Injuries
HAPUs	Hospital-Acquired Pressure Ulcers
NHS	National Health Service
CCUs	Critical Care Units/Cardiac care units
ICU	Intensive Care Unit
CPAP	Continuous Positive Airway Pressure
BiPAP or BPAP	Bi-level Positive Airway Pressure
ETT	Endotracheal Tube
NGT	Nasogastric Tube
LR	Literature Review
A	Level of significant
H_0	Null hypothesis
CEP	Continuous Education Program
MV	Mechanical Ventilation
SOFA	Sequential Organ Failure Assessment
APACHE	Acute Physiology and Chronic Health Evaluation
GCS	Glasgow Coma Scale
RNs	Registered Nurses
MDRPI-KAT	Medical Device Related Pressure Injury Knowledge Assessment Test
MDRPI-KQ	Medical Device-Related Pressure Injuries Knowledge Questionnaire
MDRPI-AQ	Medical Device Related Pressure Injury Attitude Questionnaire
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
CINAHL	Cumulated Index in Nursing and Allied Health Literature
EMBASE	Excerpta Medica Database
WHO	World Health Organization
IRB	Institution Review Board
NNUH	An-Najah National University Hospital
MICU	Medical Intensive Care Unit
SICU	Surgical Intensive Care Unit

PICU	Pediatric intensive care unit
PCCU	Post Cardiac Care Unit
O_1	Pre-test (Baseline Measurement)
X	Intervention (Educational Program)
O_2	Post-test (Follow-up Measurement)
JCI	Joint Commission International
W	Kendall's Coefficient of Concordance
CVI	Content Validity Index
PPPIA	The Pan Pacific Pressure Injury Alliance
NPIAP	National Pressure Injury Advisory Panel
EPUAP	European Pressure Ulcer Advisory Panel
ANA	American Nurses Association
SPSS	Statistical Package for Social Sciences
NIPPV	Non-Invasive Positive Pressure Ventilation
ANOVA test	One-way analysis of variance
N	Number of the Participate
SD	Stander Deviation
P-value	Probability value

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Appendices

Appendix A

Tables of Study

Table A1

Matrix Chart/Table for Studies Regarding MDRPIs

Article NO.	Article address	Year	Authors Names	Study Design	Setting	Participants	Tools Used	Findings
1.	Incidence, characteristics and risk factors of MDRPIs: An observational cohort study	2021	(Dallı et al., 2022).	A prospective observational cohort study.	The study was conducted in a university hospital in Turkey.	The study included patients over the age of 18 years who had a device in situ and stayed in the ICU for more than 24 h.	The Case Report Form, MDRPI Monitoring Form, Sequential Organ Failure Assessment (SOFA) score, Acute Physiology and Chronic Health Evaluation (APACHE-II), Braden Scale, National Pressure Injury Advisory Panel (NPIAP) staging and categories, and Glasgow Coma Scale (GCS) were used for data collection.	This study provides a comprehensive understanding of the risk of MDRPI in critically ill adults.
2.	Nurses' knowledge of MDRPIs and risk factors: A descriptive study at a large medical centre from Palestine	2024	(Omar et al., 2024)	A cross-sectional design	at a large medical centre in Palestine	Seventy-one nurses participated in the study.	MDRPIs Knowledge Questionnaire.	Poor knowledge of pressure injuries can negatively affect patient care, so training programs and policies should be developed based on the level of knowledge and practices of the staff to be more effective.

3.	Risk factors of medical device-related pressure injury in intensive care units.	2022	(Dang et al., 2022).	Cross-sectional study.	ICU at 30 hospitals in China.	694 patients.	The study methods were followed by the STROBE guidelines.	The prevalence of MDRPI in this study was still high.
4.	MDRPIs in adult intensive care units.	2023	(Celik et al., 2023).	Observation prospective study.	----------	302 patients.	The study was conducted observationally, prospectively and descriptively. The study was reported according to the STROBE Declaration.	MDRPI develops in 27.2% of patients, mainly in the nose and mouth, with diagnosis within 3-5 days. High use of medical devices and hospitalization days are significant risk factors.
5.	MDRPIs: Knowledge levels of nurses and factors affecting these.	2022	(Sönmez & Bahar, 2022).	Descriptive and cross-sectional study.	In Ankara, Turkey.	355 Nurses.	Data were collected using the Nurse Information Form and the MDRPIs Knowledge Questionnaire.	Nurses' knowledge of MDRPIs is inadequate, so regular training programs should be recommended to reduce the incidence and ensure quality patient care.
6.	Knowledge levels and attitudes of Turkish nursing students regarding MDRPIs and factors influencing them: A cross-sectional study.	2024	(Erzincanlı et al., 2024).	A descriptive cross-sectional study.	In Turkey	581 Nursing students.	Data were collected using the Student Information Form, MDRPI-KAT, and the MDRPI-AQ.	This study found that the nursing students exhibited insufficient knowledge about MDRPIs.Despite this, the nursing students demonstrated a positive attitude toward MDRPIs.

7.	Model construction of factors influencing intensive care unit nurses' medical device-related pressure injury knowledge, attitude, and practice	2023	(Sun et al., 2023).	Quantitative Cross-Sectional Study.	Tertiary hospitals in China.	322 ICU nurses.	A Clinical Nurses' Knowledge, Attitude, and Practice Questionnaire for the Prevention of MDRPI in Critically Ill Patients.	The results showed that the overall passing rate of ICU nurses' knowledge, attitude, and practice score was 72%.
8.	Effect of Implementing Educational Program about Preventive Nursing Measures of Medical devices related Pressure Injuries on Nurses' Performance and Patients' Clinical Outcome	2022	(Sayed et al., 2022).	Quasi-experimental	Surgical Intensive Care Unit Tanta University .	70 nurses 60 adult critically ill patients.	Tool (I): Demographic characteristics and nurses' knowledge about MDRPI. Tool (II) was an observational checklist used to evaluate nurses' practices. Tool (III) assessed patients' clinical outcomes.	Significant improvement in nurses' knowledge and practices immediately post-program. Improvement declined over time.
9.	Medical Device-Related Pressure Injury Care and Prevention Training Program (DevICeU): Effects on intensive care nurses'	2024	(Dallı & Girgin, 2024).	A prospective pre-posttest intervention study.	In a hospital located in the fourth largest city of Turkey.	112 Nurses.	Nurse Characteristic Form, Patient Characteristic Form, MDRPI Monitoring and Prevalence Form, D.E.V.I.C.E Performance Observation Checklist, MDRPI Knowledge Assessment Questionnaire,	The study indicated that the training on MDRPIs given to ICU nurses increased their knowledge and prevention performance and decreased the prevalence of MDRPIs.

	knowledge, prevention performance and point prevalence						Braden Pressure Ulcer Risk Assessment Scale, NPIAP Pressure Injury Grading & Feedback Form on the Training Process.	
10.	The Effectiveness of the SKINCARE Bundle in Preventing Medical-Device Related Pressure Injuries in Critical Care Units: A Clinical Trial.	2021	(Tayyib et al., 2021).	A prospective, single-arm, open-label clinical design.	In a Saudi Arabian tertiary hospital.	400 Registered Nurses (RNs).	Data were gathered using a patient checklist and included demographic and clinical data. Daily patient assessment by the primary nurses included the Braden Scale risk assessment and skin assessment tool.	The MDRPI cumulative incidence was significantly lower after the implementation of the SKINCARE bundle (0.89%, 90% lower than the historic incidence).
11.	Protocols and their effects for medical device-related pressure injury prevention among critically ill patients: a systematic review	2024	(Lee & Choi, 2024).	A systematic review.	----------	Twelve articles were finally selected.	The literature search and selection were performed following the Cochrane Handbook for Systematic Reviews of Interventions with the support Preferred Reporting Items for of the Systematic reviews and Meta-Analyses (PRISMA) Guidelines.	The study revealed a significant reduction in pressure injury incidence in medical devices attributed to strategies such as nurse education, assessment, documentation, and hydrocolloid foam dressings.
12.	Interventions and strategies to prevent medical device-related pressure injury in adult patients: A systematic review.	2023	(Lyu et al., 2023).	A systematic review.	----------	Twenty-four peer-reviewed papers.	Searched six databases, including Medline, CINAHL, EMBASE, Cochrane Library, Web of Science and ProQuest with no restriction to year of publication.	Much work has been undertaken on MDRPI prevention strategies. There were a variety of devices reported. However, more research is needed.

13.	Effectiveness of interventions to prevent pressure injury in adults admitted to intensive care settings: A systematic review and meta-analysis of randomized controlled trials.	2021	(Lovegrove et al., 2022).	A systematic review and meta-analysis of randomized controlled trials.	----------	Twenty-six trials were included.	Five databases (CINAHL, MEDLINE, Scopus, Web of Science, and Embe) were searched in mid-2019.	Only prophylactic sacral and heel dressings demonstrated effectiveness in preventing pressure injury in adults admitted to intensive care settings. Further intensive care-specific trials are required across all intervention types
14.	Medical Device-Related Pressure Injury in an Intensive Care Unit: A Cross-Sectional Study.	2021	(de Assis et al., 2021).	A Cross-Sectional Study.	In Brazil.	125 participants.	The skin of patients who consented to participate was assessed for the presence of an MDRPI, and other independent variables were abstracted from the medical records.	A study found that 34% of participants experienced Medical Device-Related Pressure Injury (MDRPI), with 58 MDRPIs. Polypharmacy, use of medical devices, and renal and respiratory diseases were significant risk factors.
15.	Prevalence, severity, and characteristics of medical device-related pressure injuries in adult intensive care patients: A prospective observational study.	2023	(Saleh & Ibrahim, 2023)	A prospective observation study.	three large referral and teaching Centres in Jordan.	329 adult patients.	Data were collected using a screening form that included demographic and clinical characteristics, and a list of medical devices.	The study revealed that 5.01% of MDRPIs (MDRPI) were skin or mucous membrane injuries, primarily caused by medical devices. Only 177 prevention and treatment interventions were provided to 15 patients.

16.	Strategies to Prevent Hospital-Acquired Pressure Injuries in the Intensive Care Unit Intensive Care Unit.	2021	(Pomerleau, 2021).	Quasi-experimental.	ICU, Hospital X in United States.	48 nurses.	Evidence-based educational suite, tandem integumentary assessment.	90% nurse attendance, improvement in quality of care, a project seen as the start of continuous improvement processes.
17.	Knowledge, perception and prevention performance of intensive care unit nurses about MDRPIs	2022	(Erbay Dalli & Kelebek Girgin, 2022).	Cross-sectional survey.	----------	142 ICU nurses.	Nurse Information Form and the MDRPI Knowledge Assessment Questionnaire.	The study result demonstrated that nurses do not perceive MDRPIs sufficiently.

Table A2

Examples of Donabedian Model Components

Structure	Process	Outcome
Staffing	Guidelines	Quality service
Qualification	Technical care	Reduce morbidity
Equipment	Protocols	Reduce mortality
Organizational structure	Pathway of care	Short stay in ICU
Checklist		

Table A3

Symbolic Representation of Study Design

Phase	Activity	Purpose
Pre-Test (O1)	Assess the baseline knowledge of participants.	To establish a knowledge baseline.
Intervention (X)	Deliver the educational program.	To improve participants' knowledge.
Post-Test (O2)	Re-assess knowledge after the intervention.	To evaluate the program's effectiveness.

Table A4

MDRPI-KQ Dimensions and Item Distribution

Category	Number of Items
Description	9 items
Risk Factors	8 items
Staging	3 items
Prevention and Treatment	16 items

Table A5

Scoring Assessment Levels Based on Correct Answer Percentages (Sönmez & Bahar, 2022)

Percentage of Correct Answers	Assessment Level	Score Range
Less than 70%	Fail	0 - 25.2
70% - 79.9%	Pass at Fair Level	25.2 - 28.8
80% - 89.9%	Pass at Good Level	28.8 - 32.4
Over 90%	Pass at Very Good Level	Above 32.4

Table A6

Test of Normality and the Skewness coefficients

Variable	Kolmogorov-Smirnov		Shapiro-Wilk		Skewness coefficient
	Statistic	P-value	Statistic	P-value	
Pre Knowledge	0.139	0.001	0.931	0.001	0.129
Pre Risk Factors	0.178	0.000	0.922	0.000	-0.235
Pre Staging	0.230	0.000	0.874	0.000	-0.078
Pre Prevention And Treatment	0.136	0.002	0.959	0.018	0.256
Pre Total Knowledge Regarding (MDRPIS)	0.088	0.200	0.970	0.077	0.098
Post Knowledge	0.444	0.000	0.484	0.000	-3.048
Post Risk Factors	0.274	0.000	0.764	0.000	-1.438
Post Staging	0.470	0.000	0.530	0.000	-1.926
Post-Prevention And Treatment	0.224	0.000	0.829	0.000	-1.274
Post Total Knowledge Regarding (MDRPIS)	0.209	0.000	0.766	0.000	-1.912

Table A7

Socio-demographic Characteristics (N=74)

Variable	Category	N	%
Age	22-25 years	11	14.9%
	26-30 years	42	56.8%
	31 years or more	21	28.4%
	Total	74	100.0%
Gender	Female	28	37.8%
	Male	46	62.2%
	Total	74	100.0%
Marital Status	Married	41	55.4%
	Single	33	44.6%
	Total	74	100.0%
Years of Experience	Less than 3 years	12	16.2%
	3-5 years	41	55.4%
	More than 5 years	21	28.4%
	Total	74	100.0%
Graduated Nursing Program	Bachelor's Degree	58	78.4%
	Postgraduate Degree	16	21.6%
	Total	74	100.0%
Department	Internal Services Medical Intensive Care Unit (MICU)	21	28.4%
	Surgical intensive care unit (SICU)	20	27.0%
	Pediatric intensive care unit (PICU)	14	18.9%
	Cardiac Care Unit (CCU)	19	25.7%
	Total	74	100.0%
Position	Head Nurse	4	5.4%
	Senior Registered Nurse (Senior RN)	31	41.9%
	Registered Nurse (RN)	39	52.7%
	Other	0	0.0%
	Total	74	100.0%

Table A8

Professional Qualifications and Training (N=74)

Variable	Category	N	%
Have you ever received training on MDRPIs?	Yes	41	55.4%
	No	33	44.6%
	Total	74	100.0%
Information Sources About MDRPIs:	In-Service Training on MDRPIs	4	9.8%
	MDRPIs Information Provided During In-Service Training	4	9.8%
	Course	12	29.3%
	Conference	16	39.0%
	Seminar/university	5	12.2%
	Other	0	0.0%
	Total	41	100.0%
Was the training on MDRPIs helpful?	Yes	35	85.4%
	No	6	14.6%
	Total	41	100.0%
Frequency of Encountering a Patient with MDRPIs:	Always	6	8.1%
	Frequently	30	40.5%
	Sometimes	34	45.9%
	Rarely	4	5.4%
	Total	74	100.0%
Information Sources About the Prevention/Treatment of MDRPIs:	Knowledge Acquired During Nursing Education	14	18.9%
	Co-working with Experienced Nurses	8	10.8%
	Suggestions/Guidance of the Physician	1	1.4%
	Journals/Books on the Subject	15	20.3%
	Internet, Newspapers, or TV	3	4.1%
	Other	33	44.6%
	Total	74	100.0%
Do you think that prevention/treatment of MDRPIs should be assumed by nurses?	Yes	72	97.3%
	No	2	2.7%
	Total	74	100.0%
Is it possible to prevent MDRPIs with good nursing care?	Yes	71	95.9%
	No	3	4.1%
	Total	74	100.0%
Are your nursing practices for the prevention/treatment of MDRPIs sufficient?	Yes	56	75.7%
	Moderately	0	0.0%
	No	18	24.3%
	Total	74	100.0%
Is a nursing care protocol necessary for the prevention of MDRPIs?	Yes	72	97.3%
	No	2	2.7%
	Total	74	100.0%
Do you think you have sufficient information about MDRPIs?	Yes	46	62.2%
	Fairly	15	20.3%
	No	13	17.6%
	Total	74	100.0%
Would you be willing to participate in training on MDRPIs?	Yes	74	100.0%
	No	0	0.0%
	Total	74	100.0%

Table A9

Means, standard deviations, and the results of T or ANOVA tests of the differences in the means of the total nurses' knowledge post-educational program according to the demographic variables

Demographic Variables	Group	N	Mean	Standard Deviation	F or T (P-value)
Age	22-25 years	11	80.81	17.05	6.219(0.003)
	26-30 years	42	90.61	9.70	
	31 years or more	21	94.44	6.97	
Gender	Female	28	90.87	11.13	0.378(0.706)
	Male	46	89.86	11.28	
Marital Status	Married	41	90.45	11.28	0.177(0.86)
	Single	33	89.98	11.17	
Years of Experience	Less than 3 years	12	83.80	13.02	2.886(0.062)
	3-5 years	41	92.34	10.63	
	More than 5 years	21	89.81	10.07	
Graduated Nursing Program	Bachelor's Degree	58	90.76	10.28	0.756(0.452)
	Postgraduate Degree	16	88.37	14.14	
Department	Internal Services Medical Intensive Care Unit (MICU)	21	86.77	14.08	0.976(0.409)
	Surgical intensive care unit (SICU)	20	92.22	7.35	
	Pediatric intensive care unit (PICU)	14	91.07	13.48	
	Cardiac Care Unit (CCU)	19	91.37	8.73	
Position	Head Nurse	4	95.83	6.61	1.73(0.185)
	Senior Registered Nurse (Senior RN)	31	92.20	8.38	
	Registered Nurse (RN)	39	88.11	13.01	
Training	Yes	41	87.26	13.41	-2.869(0.006)
	No	33	93.94	5.83	

*The dependent variable is the total nurses' knowledge post-educational program.

Table A10

Tukey Post-hoc Pairwise Comparisons

Age (I)	Age (J)	Mean Difference (I-J)	Std. Error	P-value
22-25 years	26-30 years	-9.800*	3.536	0.019
	31 years or more	-13.636*	3.886	0.002
26-30 years	22-25 years	9.800*	3.536	0.019
	31 years or more	-3.836	2.790	0.359
31 years or more	22-25 years	13.636*	3.886	0.002
	26-30 years	3.836	2.790	0.359

*The mean difference is significant at the .05 level.

Appendix B

Figures of Study

Figure B1

Age Group Distribution via Pie Chart

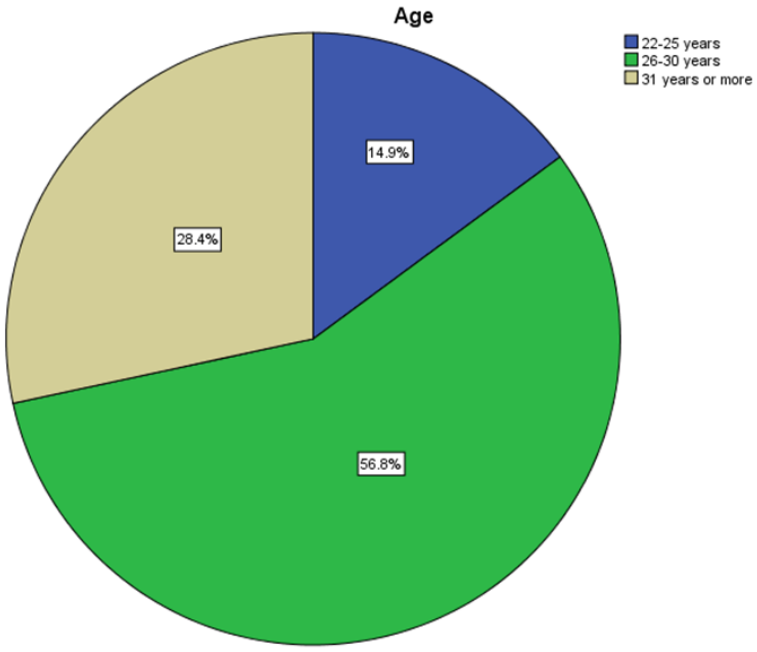


Figure B2

Gender Group Distribution via Pie Chart

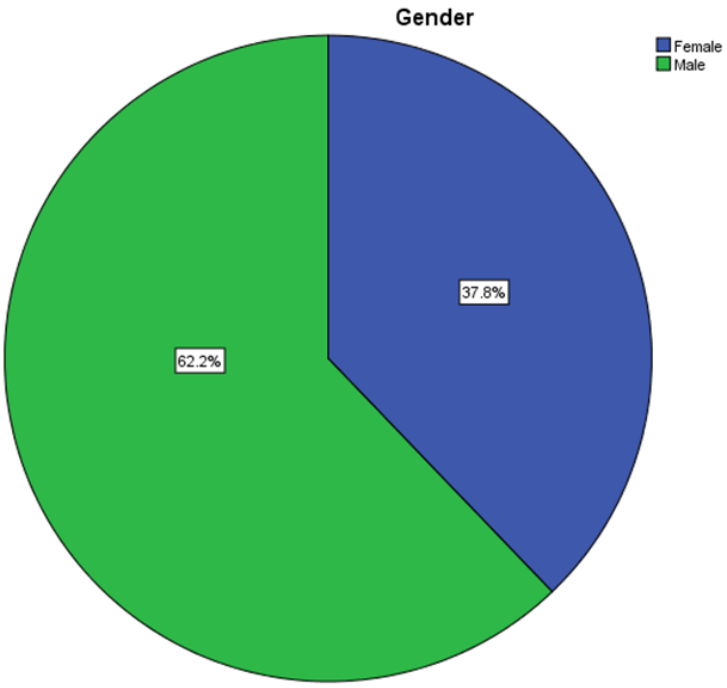


Figure B3

Martial status Distribution via Pie Chart

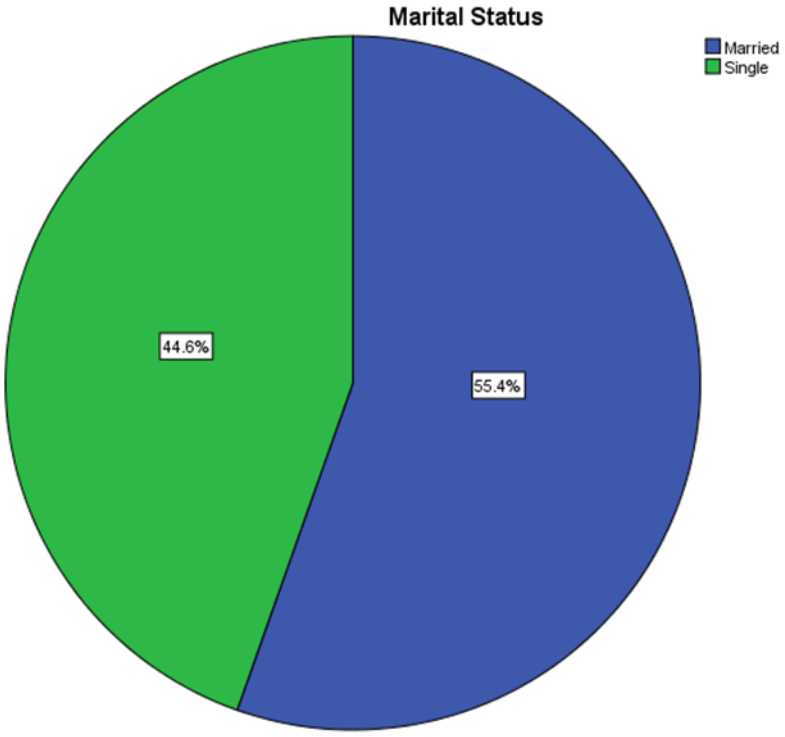


Figure B4

Years of experience Distribution via Pie Chart

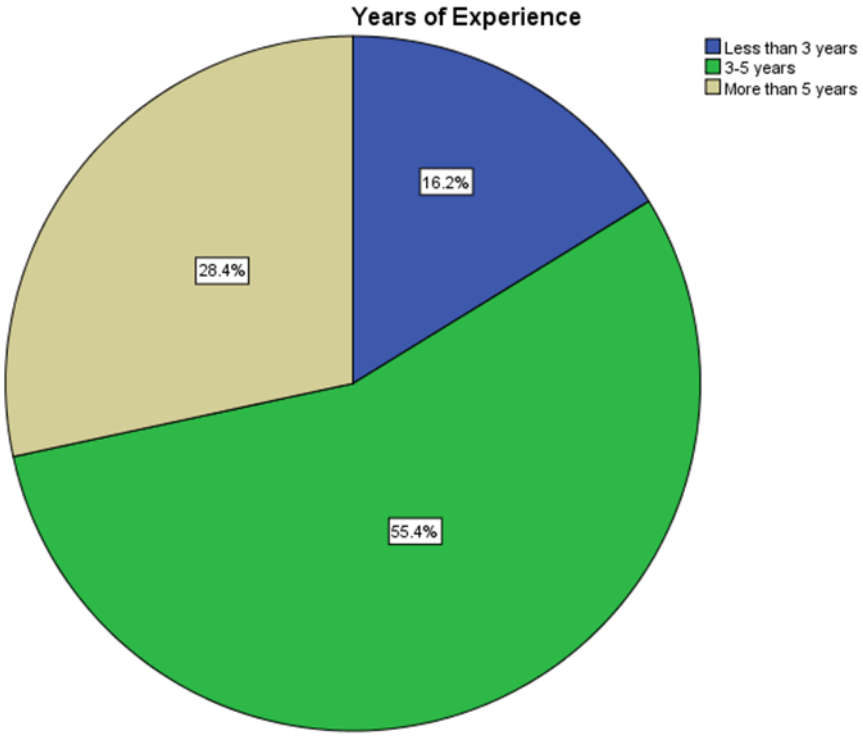


Figure B5

Graduated nursing program Distribution via Pie Chart

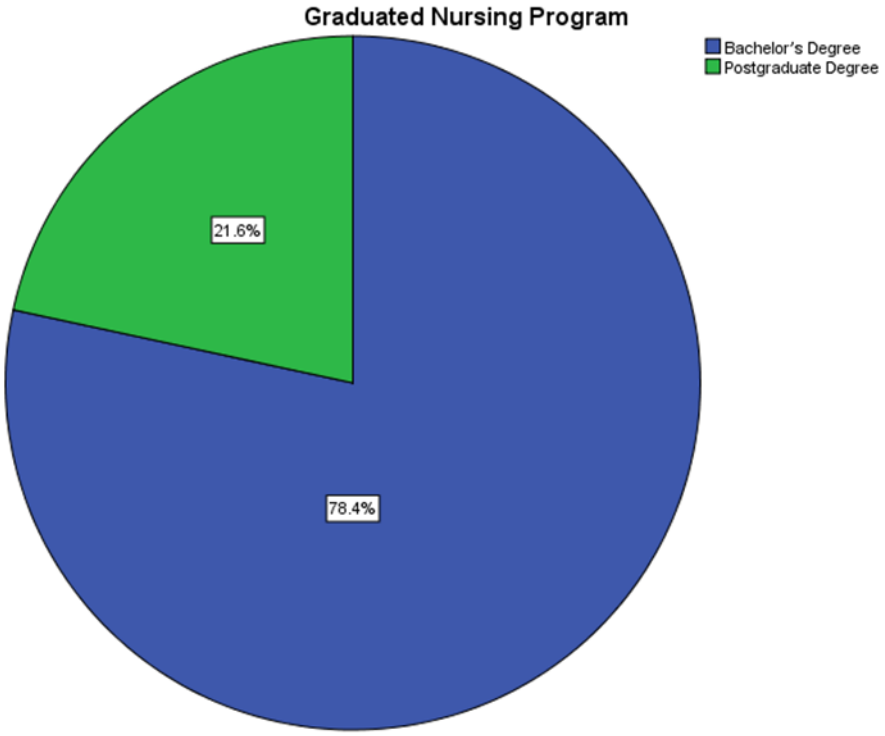


Figure B6

Department Distribution via Pie Chart

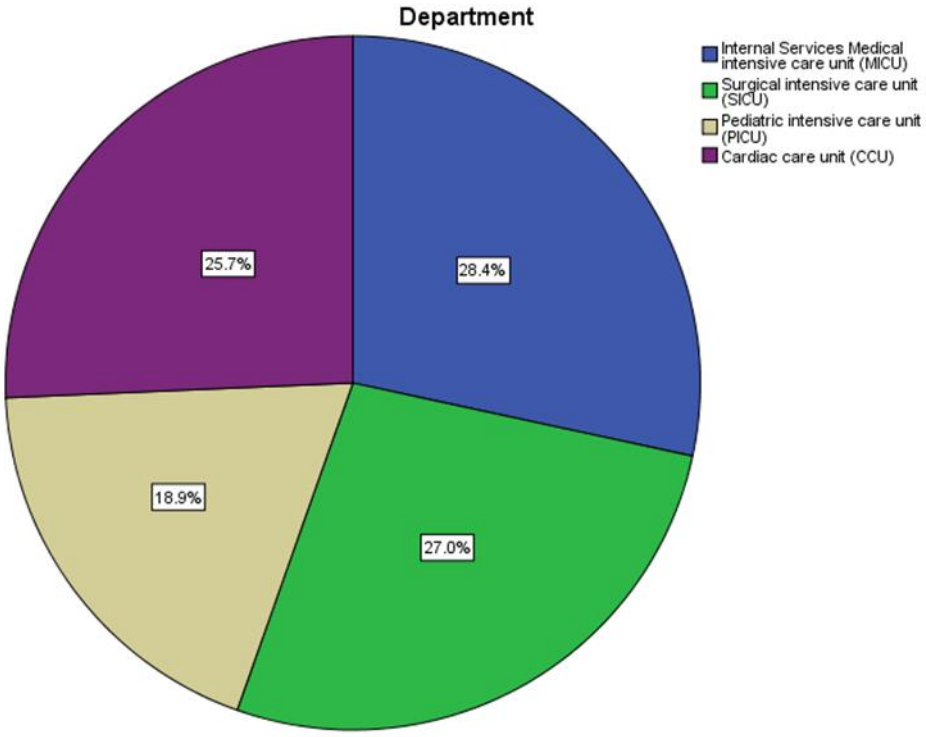


Figure B7

Position Distribution via Pie Chart

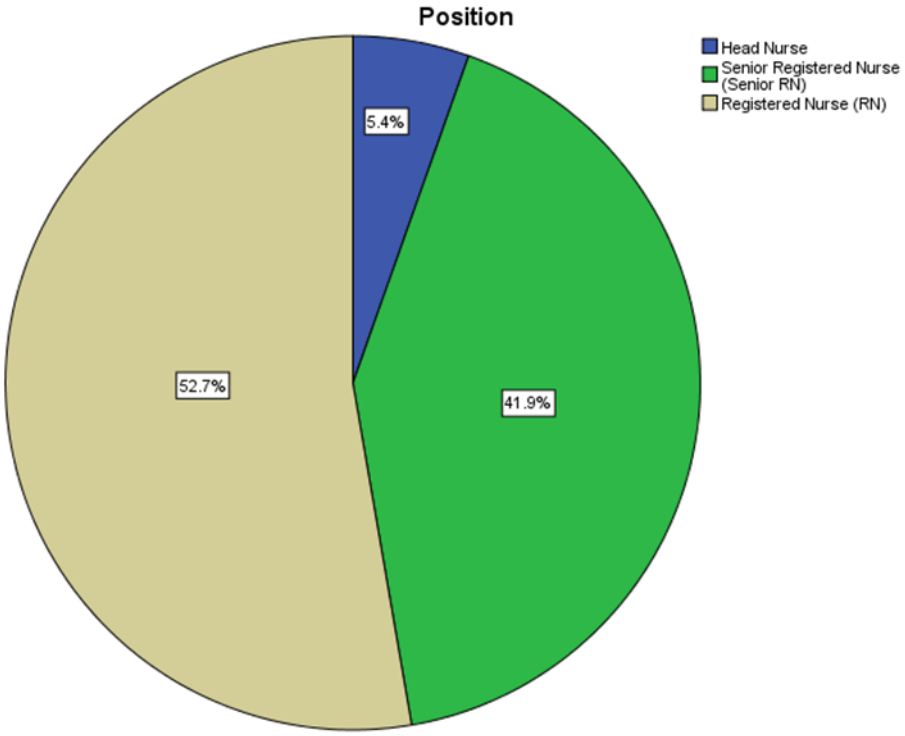
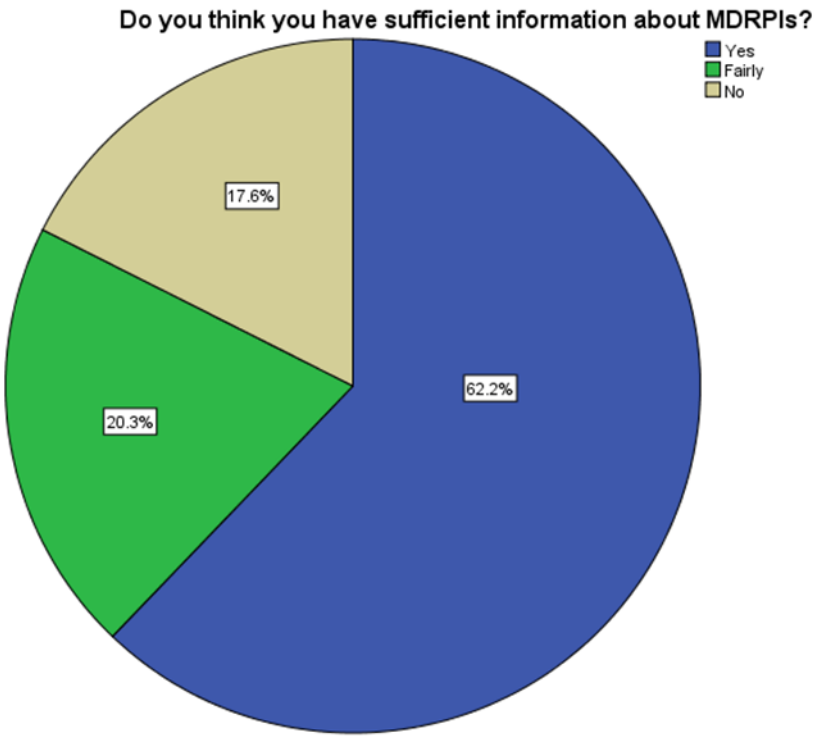


Figure B8

Do you think you have sufficient information about MDRPIs?



Appendix C

Questionnaire

The Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent MDRPIs.

فعالية استخدام البرنامج التعليمي في تحسين معرفة ممرضي العناية المكثفة للوقاية من إصابات الضغط المرتبطة بالأجهزة الطبية.

Part A: Nurse Information Form
الجزء أ: استمارة معلومات الممرض

Section 1: Sociodemographic Characteristics
القسم 1: الخصائص الاجتماعية والديموغرافية

1. **Age**: Write the age in years — **العمر: اكتب العمر بالسنوات**

2. **Gender:** — **الجنس:**
   - o Female — أنثى
   - o Male — ذكر

3. **Marital Status:** — **الحالة الاجتماعية :**
   - o Married — متزوج/ة
   - o Single — أعزب/عزباء

4. **Work of experience:** — **سنوات الخبرة العملية:**
   - o 6 months -1 year — من 6 أشهر إلى سنة
   - o 1 year-3 years — من سنة إلى 3 سنوات
   - o 3 years-5 years — من 3 سنوات إلى 5 سنوات
   - o >5 years — أكثر من 5 سنوات

5. **Most Recently Graduated Nursing Program:** **أحدث برنامج تم التخرج منه في التمريض**
   - Diploma
     دبلوم
   - Bachelor's Degree درجة
     البكالوريوس
   - Postgraduate Degree درجة الدراسات
     العليا

6. **Department Currently Worked In:** **القسم الذي تعمل فيه حاليًا**
   - Internal Services Medical intensive care unit (MICU). وحدة العناية المركزة
     الباطنية
   - Surgical intensive care unit (SICU). وحدة العناية المركزة الجراحية
   - Pediatric intensive care unit (PICU). وحدة العناية المركزة للأطفال
   - Cardiac care unit (CCU). وحدة العناية القلبية

7. **Position in the Department:** **المسمى الوظيفي في القسم**
   - Head Nurse رئيس
     قسم
   - Senior Registered Nurse (Senior RN) ممرض قانوني
     أول
   - Registered Nurse (RN) ممرض
     قانوني
   - Other
     أخرى

Section 2: Professional Qualifications and Training **القسم 2: المؤهلات المهنية والتدريب**

8. **Have you ever received training on MDRPIs?**
   هل سبق لك تلقي تدريب حول إصابات الضغط المرتبطة بالأجهزة الطبية؟
   - Yes
   - No
9. **Information Sources About MDRPIs**:
   مصادر المعلومات حول إصابات الضغط المرتبطة بالأجهزة الطبية:
   - In-Service Training on MDRPIs
   - MDRPIs Information Provided During In-Service Training
   - Course:
   - Conference
   - Seminar
   - Other

10. **Was the training on MDRPIs helpful?**

هل كان التدريب على إصابات الضغط المرتبطة بالأجهزة الطبية مفيدًا؟

- Yes
- No

11. **Frequency of Encountering a Patient with MDRPIs**:

عدد مرات مواجهتك لمريض مصاب بإصابات الضغط المرتبطة بالأجهزة الطبية:

- Always
- Frequently
- Sometimes
- Rarely

12. **Information Sources About the Prevention/Treatment of MDRPIs**:

مصادر المعلومات حول الوقاية/العلاج من إصابات الضغط المرتبطة بالأجهزة الطبية:

- Knowledge Acquired During Nursing Education
- Co-working with Experienced Nurses
- Suggestions/Guidance of the Physician
- Journals/Books on the Subject
- Internet, Newspapers, or TV
- Other

13. **Do you think that prevention/treatment of MDRPIs should be assumed by nurses?**

هل تعتقد أن الوقاية/العلاج من إصابات الضغط المرتبطة بالأجهزة الطبية يجب أن تكون مسؤولية الممرضين؟

- Yes
- No

14. **Is it possible to prevent MDRPIs with good nursing care?**

هل يمكن الوقاية من إصابات الضغط المرتبطة بالأجهزة الطبية من خلال الرعاية التمريضية الجيدة؟

- Yes
- No

15. **Are your nursing practices for the prevention/treatment of MDRPIs sufficient?**

هل ممارساتك التمريضية للوقاية/العلاج من إصابات الضغط المرتبطة بالأجهزة الطبية كافية؟

- Yes
- Moderately
- No

16. **Is a nursing care protocol necessary for the prevention of MDRPIs?**

هل هناك حاجة إلى بروتوكول رعاية تمريضية للوقاية من إصابات الضغط المرتبطة بالأجهزة الطبية؟

- Yes
- No

17. **Do you think you have sufficient information about MDRPIs?**

هل تعتقد أن لديك معلومات كافية حول إصابات الضغط المرتبطة بالأجهزة الطبية؟

- Yes
- Fairly
- No

18. **Would you be willing to participate in training on MDRPIs?**
هل ترغب في المشاركة في تدريب حول إصابات الضغط المرتبطة بالأجهزة الطبية؟

- Yes
- No

Part B: MDRPI-KQ
الجزء ب: استبيان المعرفة حول إصابات الضغط المرتبطة بالأجهزة الطبية

Knowledge Items **أسئلة المعرفة**

1. MDRPIs are pressure injuries caused by medical devices and equipment. (T) True / False
إصابات الضغط المرتبطة بالأجهزة الطبية هي إصابات ضغط ناتجة عن الأجهزة والمعدات الطبية.

2. MDRPIs are caused by constant pressure or friction due to medical devices. (T)True / False
تحدث إصابات لضغط المرتبطة بالأجهزة الطبية بسبب الضغط المستمر أو الاحتكاك الناتج عن الأجهزة الطبية.

3. MDRPIs constitute approximately 1/3 of all pressure injuries that may occur in the hospital environment. (T)True / False
تشكل إصابات الضغط المرتبطة بالأجهزة الطبية حوالي ثلث جميع إصابات الضغط التي قد تحدث في البيئة الاستشفائية.

4. In MDRPIs, the tissue around or under the device and equipment takes the shape of the device. (T)True / False
تأخذ الأنسجة المحيطة أو الموجودة تحت الجهاز الطبي في إصابات الضغط المرتبطة بالأجهزة الطبي نفس شكل الجهاز.

5. The source of pressure in MDRPIs is the medical device itself. (T)True / False
مصدر الضغط في إصابات الضغط المرتبطة بالأجهزة الطبية هو الجهاز الطبي نفسه.

6. MDRPIs usually occur in areas with bony prominences. (F)True / False
عادةً ما تحدث إصابات الضغط المرتبطة بالأجهزة الطبية في المناطق ذات البروزات العظمية.

7. MDRPIs are simple wounds and do not cause serious complications. (F)True / False
تعتبر إصابات الضغط المرتبطة بالأجهزة الطبية جروحًا بسيطة ولا تسبب مضاعفات خطيرة.

8. MDRPIs are most common in the sacrum. (F)True / False
تعد إصابات الضغط المرتبطة بالأجهزة الطبية أكثر شيوعًا في منطقة العجز.

9. There are no differences in the appearance of general pressure injuries and MDRPIs. (F)True / False
لا توجد اختلافات في مظهر إصابات الضغط العامة وإصابات الضغط المرتبطة بالأجهزة الطبية.

Risk Factors **عوامل الخطر**

10. Hypertension is not a risk factor for MDRPIs. (T) True / False
لا يُعتبر ارتفاع ضغط الدم عامل خطر لإصابات الضغط المرتبطة بالأجهزة الطبية.

11. MDRPIs are potentially caused only by breathing apparatus and feeding tubes. (F)True / False
تُسبب أجهزة التنفس الصناعي وأنابيب التغذية فقط إصابات الضغط المرتبطة بالأجهزة الطبية.

12. Hypoalbuminemia and malnutrition are not causes of MDRPIs. (F)True / False
نقص الألبومين وسوء التغذية ليسا من أسباب إصابات الضغط المرتبطة بالأجهزة الطبية.

13. All patients with a medical device are at risk for MDRPIs. (T)True / False
جميع المرضى الذين يستخدمون جهازًا طبيًا معرضون لخطر الإصابة بـ إصابات الضغط المرتبطة بالأجهزة الطبية.

14. Patients with signs of localized and generalized edema have a higher risk of MDRPIs. (T)True / False
المرضى الذين يعانون من وذمة موضعية أو عامة معرضون بشكل أكبر لخطر إصابات الضغط المرتبطة بالأجهزة الطبية.

15. Patients with swallowing problems are at risk of MDRPIs. (T) True / False
المرضى الذين يعانون من مشاكل في البلع معرضون لخطر إصابات الضغط المرتبطة بالأجهزة الطبية.

16. Face masks used for non-invasive positive pressure ventilation (NIPPV) do not cause MDRPIs. (F) True / False
لا تتسبب أقنعة الوجه المستخدمة في التهوية غير الغازية في حدوث إصابات الضغط المرتبطة بالأجهزة الطبية.

17. Commonly used risk assessment scales do not assess the risk associated with MDRPIs. (T)True / False
المقاييس المستخدمة بشكل شائع لتقييم مخاطر الإصابة لا تأخذ في الاعتبار المخاطر المرتبطة بإصابات الضغط المرتبطة بالأجهزة الطبية.

Staging **تصنيف المراحل**

18. The most common stage of encountering a MDRPI is stage 2. (T)True / False
المرحلة الأكثر شيوعًا من إصابات الضغط المرتبطة بالأجهزة الطبية هي المرحلة الثانية.

19. If the medical device causes a pressure injury on the mucosa, staging is achieved using the “International Pressure Ulcer Classification System.” (F) True / False
إذا تسبب الجهاز الطبي في إصابة الضغط على الغشاء المخاطي، يتم تصنيفها وفقًا لـ "النظام الدولي لتصنيف تقرحات الضغط.

20. If the medical device causes a pressure injury on the skin, no staging is required. (F)True / False
    اذا تسبب الجهاز الطبي في إصابة الضغط على الجلد، فلا حاجة لتصنيفها.

Prevention and Treatment **الوقاية والعلاج**

21. Placing the medical device or equipment under the immobile patient should be avoided. (T)True / False
    يجب تجنب وضع الأجهزة الطبية تحت المريض غير المتحرك.

22. MDRPIs do not require any treatment and heal spontaneously. (F)True / False
    لا تتطلب إصابات الضغط المرتبطة بالأجهزة الطبية أي علاج وتشفى تلقائيًا.

23. The skin around and under medical devices or equipment should be observed every 48–72 hours for signs of injuries. (F)True / False
    يجب مراقبة الجلد حول الأجهزة الطبية وتحتها كل 48-72 ساعة للكشف عن علامات الإصابة.

24. If the patient is at risk of edema or exhibits signs of edema, skin assessment should be performed more frequently than usual. (T)True / False
    إذا كان المريض معرضًا لخطر الوذمة أو ظهرت عليه علامات الوذمة، يجب تقييم الجلد بشكل أكثر تكرارًا من المعتاد.

25. Medical devices, except for the endotracheal tube, should be relocated periodically to redistribute pressure. (F)True / False
    يجب إعادة وضع الأجهزة الطبية باستثناء أنبوب التنفس بشكل دوري لإعادة توزيع الضغط.

26. Medical devices and equipment should be removed from the part of the body they are attached to as soon as medically possible. (T)True / False
    يجب إزالة الأجهزة الطبية والمعدات من الجزء المتصل بالجسم بمجرد أن يكون ذلك ممكنًا طبيًا.
    .

27. Relocating the medical devices at regular intervals is the most important preventive method to prevent MDRPIs. (T)True / False
    عادة وضع الأجهزة الطبية بانتظام هي أهم طريقة وقائية لمنع إصابات الضغط المرتبطة بالأجهزة الطبية.

28. The skin surface in the area where the medical device is located should be massaged to prevent MDRPIs. (F)True / False
    يجب تدليك سطح الجلد في المنطقة التي يوجد بها الجهاز الطبي لمنع إصابات الضغط المرتبطة بالأجهزة الطبية.

29. If the dietary plan of adult patients at risk of MDRPIs does not meet nutritional requirements, a protein-rich nutritional supplement should be recommended. (T)True / False

إذا كانت الخطة الغذائية للمرضى البالغين المعرضين لخطر إصابات الضغط المرتبطة بالأجهزة الطبية لا تفي بالاحتياجات الغذائية، فيجب التوصية بمكمل غذائي غني بالبروتين.

30. Using medical devices in a way that minimizes skin damage (soft material, etc.) reduces the risk of injury formation. (T)True / False

استخدام الأجهزة الطبية بطريقة تقلل من تلف الجلد (مثل المواد اللينة) يقلل من خطر الإصابة.

31. Medical devices and equipment should be firmly fixed on to avoid the risk of dislocation. (F)True / False

يجب تثبيت الأجهزة الطبية بإحكام لتجنب خطر الانزلاق.

32. The medical device should be placed directly on the skin. (F)True / False

يجب وضع الجهاز الطبي مباشرة على الجلد.

33. The skin on which medical devices are worn should be regularly moistened with moisturizing products to prevent MDRPIs. (F)True / False

يجب ترطيب الجلد الذي يتم ارتداء الأجهزة الطبية عليه بانتظام لمنع إصابات الضغط المرتبطة بالأجهزة الطبية.

34. The skin on which medical devices are worn should be kept clean and dry to prevent MDRPIs. (T)True / False

يجب الحفاظ على الجلد الذي يتم ارتداء الأجهزة الطبية عليه نظيفًا وجافًا لمنع إصابات الضغط المرتبطة بالأجهزة الطبية.

35. Medical devices and equipment should be the appropriate size for the patient. (T)True / False

يجب أن تكون الأجهزة الطبية والمعدات بحجم مناسب للمريض.

36. To reduce the pressure associated with the medical device, a specific dressing/pad should be used under the devices. (T)True / False

لتقليل الضغط المرتبط بالجهاز الطبي، يجب استخدام ضمادة أو وسادة خاصة تحت الأجهزة.

Appendix D

Request for Permission to Use Questionnaire

Request for Permission to Use Your Questionnaire

Suhaila Kharoosheh <suhaila.kh02@gmail.com> 8:11 PM (4 minutes ago)
to munevverunlu@gmail.com, arzbahar

Dear Münevver Sönmez & Arzu Bahar

I hope this message finds you well.

My name is Suhaila Kharoosheh, and I am a Master's student in Critical Care Nursing at the Department of Graduate Studies, Faculty of Nursing,at An-Najah National University. I am currently working on a research project titled The Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent Medical Device-Related Pressure Injuries (MDRPIs). which focuses on evaluating the effectiveness of an educational program in enhancing Intensive Care Nurses' knowledge regarding the prevention of Medical Device-Related Pressure Injuries (MDRPIs).

I came across your questionnaire titled The Nurse Information Form and the Medical DeviceRelated Pressure Injuries Knowledge Questionnaire in your study Medical device-related pressure injuries: Knowledge levels of nurses and factors affecting these published in Journal of Tissue Viability Society. I found it highly relevant to my research objectives and believe it would be a valuable tool for data collection in my study.

I am writing to kindly request your permission to use your questionnaire for academic purposes. I assure you that full credit will be given to you in my work, and the questionnaire will only be used within the scope of this study.

If there are any specific conditions or requirements for using the questionnaire, please let me know. I would also appreciate it if you could share any additional guidance or materials related to the questionnaire, if available.

Thank you for considering my request. I would be grateful for your permission and any advice you might provide. Please feel free to contact me at suhaila.kh02@gmail.com for further details about my research.

Looking forward to your response.

Best regards,
Suhaila Kharoosheh.
Affiliation: An-Najah National University, Graduate Studies, Intensive Care Nursing.
Master's Student in Critical Care Nursing
Email: suhaila.kh02@gmail.com

Request for Permission to Use Your Questionnaire Inbox ×

Suhaila Kharoosheh
Dear Münevver Sönmez & Arzu Bahar I hope this message finds you well. My name is Suhaila Kharoosheh, and I am a Master's student in Critical Care Nursing at the

Arzu Bahar
to me, munevverunlu@gmail.com

Yes, of course you can. I received the questionnaire end of the mail. Best wishes

Suhaila Kharoosheh <suhaila.kh02@gmail.com>, 13 Oca 2025 Pzt, 21:11 tarihinde şunu yazdı:
•••

--
-Doçent.Dr. Arzu BAHAR
Yüksek İhtisas Üniversitesi
Sağlık Bölümleri Fakültesi/ Hemşirelik Esasları Anabilim Dalı-Ankara-TÜRKİYE
-Associate Professor. PhD, RN, Arzu Bahar,
Yuksek Ihtisas University, Faculty of Health Sciences, Fundamentals of Nursing, Ankara, TURKEY

One attachment • Scanned by Gmail

Appendix E

Consent Form for Participation in Research

Consent Form for Participation in Research on the Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent MDRPIs.

Dear Participant,

My name is Suhaila Kharoosheh, and I am a graduate student at An-Najah National University, specializing in Intensive Care Nursing. I am conducting a study to evaluate the effectiveness of implementing an educational program on MDRPIs. The aim of this study is to improve the knowledge of nurses about the prevention of the medical devices related to pressure injury by using an evidence-based education program at An-Najah National University Hospital in the northern West Bank of Palestine .This research is being carried out under the supervision of DR. Aidah Alkaissi as a part of my graduation project requirements.

Purpose of the Study:
The purpose of this study is to evaluate the effectiveness of an educational program in enhancing Intensive Care Nurses' knowledge regarding the preventing MDRPIs.

Procedures:
•You will be asked to complete a questionnaire before and after attending the educational sessions.
•The training program will include theoretical components to improve your understanding of MDRPIs.

Voluntary Participation:
Your participation in this study is entirely voluntary. You may withdraw at any time without any consequences to your professional standing.

Confidentiality:
Your responses and personal information will be kept strictly confidential. Unique identification numbers will replace your name to ensure anonymity. The data will be used for research purposes only.

Potential Benefits:
Participation in this study will provide you with knowledge to prevent MDRPIs, ultimately improving patient outcomes.

Potential Risks:
There are no known risks associated with this study.

Consent to Participate:
By signing this form, you confirm that you:

- Have read and understood the information provided.
- Voluntarily agree to participate in the study.
- Understand that you can withdraw at any time without penalty.

If you have any questions about this study, please feel free to contact Suhaila Kharoosheh.

Study Title: The Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent MDRPIs.

Principal Investigator: Suhaila Kharoosheh.
Affiliation: An-Najah National University, Graduate Studies, Intensive Care Nursing.
Position: RN on Medical Ward-NNUH.
Mobile No: 0569635188
Email: suhaila.kharousheh@najah.edu

_____

Participant Name: _____
Participant Signature: _____
Date: _____

نموذج الموافقة للمشاركة في البحث حول فعالية استخدام برنامج التعليم على معرفة ممرضي العناية المركزة للوقاية من إصابات الضغط المرتبطة بالأجهزة الطبية.(MDRPIs)

بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

- عزيزي المشارك،

اسمي سهيله خروشه، أنا طالبة دراسات عليا في جامعة النجاح الوطنية،أدرس تخصص تمريض العناية المركزة. أنا بصدد إجراء دراسة لتقييم فعالية تطبيق برنامج تعليمي حول إصابات الضغط المرتبطة بالأجهزة الطبية . تهدف هذه الدراسة إلى تحسين معلومات الممرضين حول الوقاية من إصابات الضغط المرتبطة بالأجهزة الطبية باستخدام برنامج تعليمي مبني على الأدلة العلمية في مستشفى النجاح الوطني الجامعي في الضفة الغربية الشمالية في فلسطين. يتم تنفيذ هذا البحث تحت إشراف الدكتورة عائدة القيسي كجزء من متطلبات مشروعي التخرج.

الغرض من الدراسة:

الغرض من هذه الدراسة هو تقييم فعالية البرنامج التعليمي في تعزيز معرفة ممرضي العناية المركزة حول الوقاية من إصابات الضغط المرتبطة بالأجهزة الطبية.(MDRPIs) .

الإجراءات:

سيُطلب منك إكمال استبيان قبل وبعد حضور الجلسات التعليمية.

يتضمن البرنامج التدريبي مكونات نظرية لتحسين فهمك حول اصابات الضغط المرتبطة بالأجهزة الطبية.

المشاركة الطوعية:

مشاركتك في هذه الدراسة طوعية تمامًا. يمكنك الانسحاب في أي وقت دون أي عواقب على وضعك المهني.

السرية:

سيتم الاحتفاظ بإجاباتك ومعلوماتك الشخصية بسرية تامة. سيتم استبدال اسمك بأرقام تعريفية فريدة لضمان عدم الكشف عن هويتك. ستُستخدم البيانات لأغراض البحث فقط.

الفوائد المحتملة:

ستوفر لك المشاركة في هذه الدراسة المعرفة اللازمة للوقاية من اصابات الضغط المرتبطة بالأجهزة الطبية.

المخاطر المحتملة:

لا توجد مخاطر معروفة او محتملة مرتبطة بهذه الدراسة.

الموافقة على المشاركة:

بتوقيعك على هذا النموذج، تؤكد أنك

قرأت وفهمت المعلومات المقدمة

توافق طوعًا على المشاركة في الدراسة

تدرك أنك تستطيع الانسحاب في أي وقت دون جزاء

إذا كان لديك أي أسئلة حول هذه الدراسة، فلا تتردد في الاتصال بي

عنوان الدراسة: فعالية استخدام برنامج التعليم على معرفة ممرضي العناية المركزة للوقاية من إصابات الضغط المرتبطة
بالأجهزة الطبية.

الباحث الرئيسي: سهيله خروشه

الانتساب: جامعة النجاح الوطنية،قسم الدراسات العليا، تخصص تمريض العناية المركزة

الوظيفة: ممرضة قانونية في قسم الباطني – مستشفى النجاح الوطني الجامعي.

رقم الجوال: 0569635188

البريد الإلكتروني: suhaila.kharousheh@najah.edu

اسم المشارك :----------

توقيع المشارك:----------

التاريخ:----------

Appendix F

Education program

https://drive.google.com/file/d/1covCZ9h9QgaDQtglFDlyqb-kMQYbhNsf/view

Suhaila's thesis\MDRPIs (MDR Is); Understanding Prevention and Management (Education program by Suhaila Kh) (1).pptx

Appendix G

Concise Guidelines: MDRPI-Prevention

https://www.myamericannurse.com/wp-content/uploads/2018/10/MDRPI-PreventionFINAL.pdf

MDRPI-Prevention.pdf

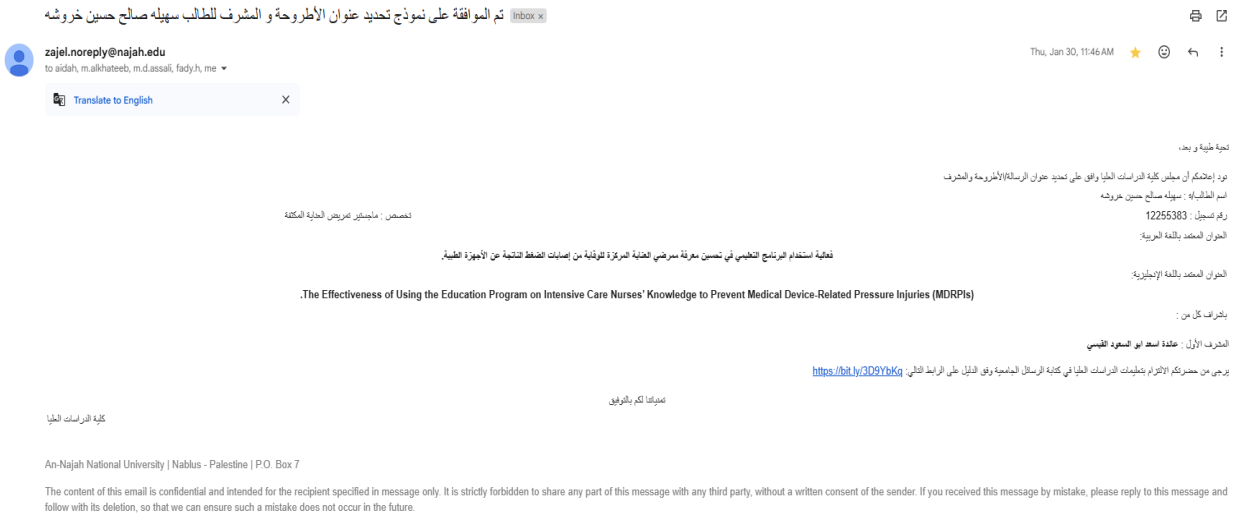
Appendix H

Poster Evidence-based practice MDRPIs prevention

https://www.myamericannurse.com/wp-content/uploads/2018/10/ant10-Pressure-Injuries-918.pdf
Master degree research suhaila kh\Evidence-based practice MDRPIs prevention.pdf

Appendix I

Thesis Title and Supervisor Approval Form



تم الموافقة على نموذج تحديد عنوان الأطروحة و المشرف للطالب سهيله صالح حسين خروشه Inbox ×

zajel.noreply@najah.edu
to aidah, m.alkhateeb, m.d.assali, fady.h, me

Thu, Jan 30, 11:46 AM

Translate to English

تحية طيبة و بعد،

نود إعلامكم أن مجلس كلية الدراسات العليا وافق على تحديد عنوان الرسالة/الأطروحة والمشرف

اسم الطالب/ة : سهيله صالح حسين خروشه

رقم تسجيل : 12255383

تخصص : ماجستير تمريض العناية المكثفة

العنوان المعتمد باللغة العربية:

فعالية استخدام البرنامج التعليمي في تحسين معرفة ممرضي العناية المركزة للوقاية من إصابات الضغط الناتجة عن الأجهزة الطبية.

العنوان المعتمد باللغة الإنجليزية:

.The Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent Medical Device-Related Pressure Injuries (MDRPIs)

بإشراف كل من :

المشرف الأول : **عائدة اسعد ابو السعود القيسي**

يرجى من حضرتكم الالتزام بتعليمات الدراسات العليا في كتابة الرسائل الجامعية وفق الدليل على الرابط التالي: https://bit.ly/3D9YbKq

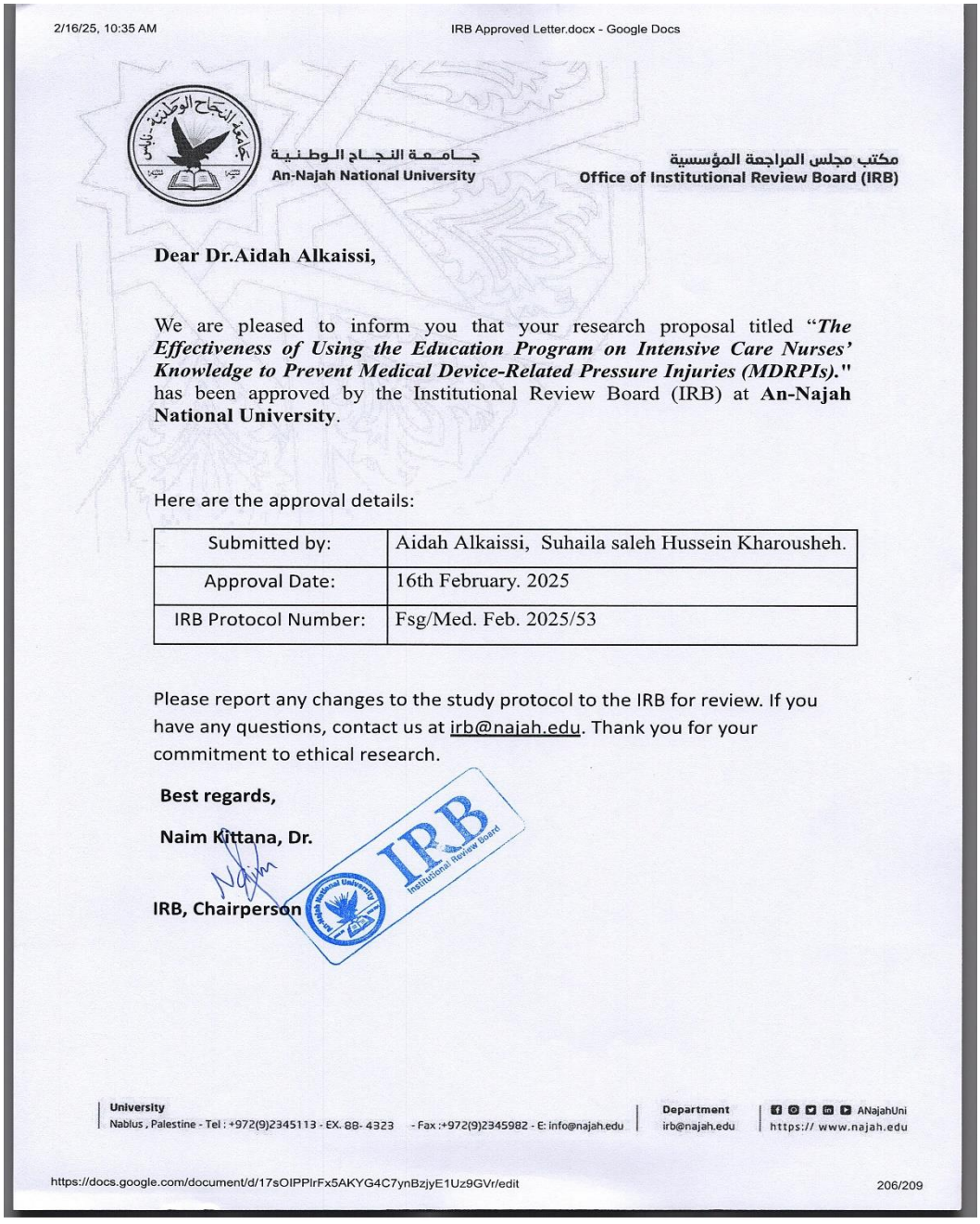
تمنياتنا لكم بالتوفيق

كلية الدراسات العليا

An-Najah National University | Nablus - Palestine | P.O. Box 7

Appendix J

IRP Approval letter at An-Najah National University



2/16/25, 10:35 AM IRB Approved Letter.docx - Google Docs

جـــامـعـة النـجـــاح الـوطـنـيـة
An-Najah National University

مكتب مجلس المراجعة المؤسسية
Office of Institutional Review Board (IRB)

Dear Dr.Aidah Alkaissi,

We are pleased to inform you that your research proposal titled "***The Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent Medical Device-Related Pressure Injuries (MDRPIs).***" has been approved by the Institutional Review Board (IRB) at **An-Najah National University**.

Here are the approval details:

Submitted by:	Aidah Alkaissi, Suhaila saleh Hussein Kharousheh.
Approval Date:	16th February. 2025
IRB Protocol Number:	Fsg/Med. Feb. 2025/53

Please report any changes to the study protocol to the IRB for review. If you have any questions, contact us at irb@najah.edu. Thank you for your commitment to ethical research.

Best regards,

Naim Kittana, Dr.

IRB, Chairperson

IRB Institutional Review Board

University
Nablus , Palestine - Tel : +972(9)2345113 - EX. 88- 4323 - Fax :+972(9)2345982 - E: info@najah.edu

Department
irb@najah.edu

ANajahUni
https:// www.najah.edu

https://docs.google.com/document/d/17sOIPPlrFx5AKYG4C7ynBzjyE1Uz9GVr/edit 206/209

Appendix K

Official Cover letter from your Institution: (cover letter directed from your dean/head to the medical director of NNUH requesting permission to collect data

بسم الله الرحمن الرحيم

An-Najah National University
Faculty Of Nursing

جـــامـــعـــة النـجـــاح الـوطـنـيـة
كليـــة التمـريـض

التاريخ: 2025/02/19

حضرة الأستاذ ابراهيم الزبيدي / مدير دائرة التمريض في مستشفى النجاح الوطني الجامعي ،

الموضوع: تسهيل مهمـة طالب الماجستير سهيله صالح حسين خروشه / ماجستير تمريض العناية المكثفة.

تحية طيبة وبعد،

تهديكم كلية في جامعة النجاح الوطنية أطيب التحيات ونشكر لحضرتكم حسن تعاونكم معنا ونرجو التكرم بالموافقه على تسهيل مهمة الطالبة المذكورة أعلاه في مستشفاكم الموقر، حيث أنه سيقوم بعمل دراسة بغرض البحث العلمي لأطروحة التخرج من برنامج الماجستير تحت عنوان:

(The Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent Medical Device-Related Pressure Injuries (MDRPIs)).

بالعربي:

(فعالية استخدام البرنامج التعليمي في تحسين معرفة ممرضي العناية المركزة للوقاية من إصابات الضغط الناتجة عن الأجهزة الطبية.)

في الفتره الواقعه ما بين: شهر 2 الى شهر 4 للعام 2025

تحت اشراف: الدكتورة عائدة أبو السعود القيسي.

-مرفق ملخص الدراسه و IRB

Data Sheet-

وتفضلوا بقبول الطلب ولكم فائق الاحترام ، ،

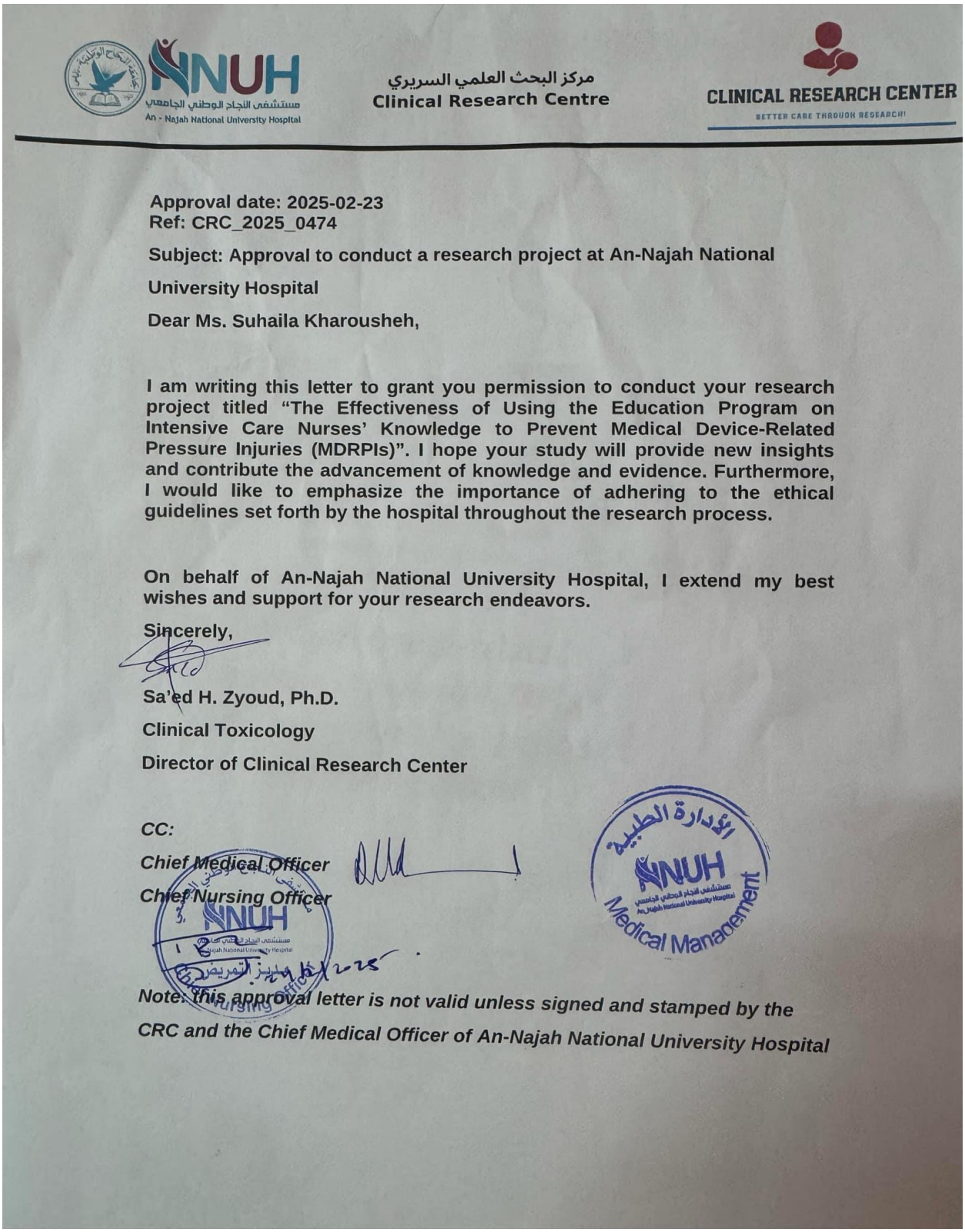
ق.أ.عميد كلية التمريض

د. عائدة أبو السعود القيسي

جامعة النجاح الوطنية

Appendix L

Approval to conduct a research project at An-Najah National University Hospital (NNUH)



مركز البحث العلمي السريري
Clinical Research Centre

CLINICAL RESEARCH CENTER
BETTER CARE THROUGH RESEARCH!

Approval date: 2025-02-23
Ref: CRC_2025_0474

Subject: Approval to conduct a research project at An-Najah National University Hospital

Dear Ms. Suhaila Kharousheh,

I am writing this letter to grant you permission to conduct your research project titled "The Effectiveness of Using the Education Program on Intensive Care Nurses' Knowledge to Prevent Medical Device-Related Pressure Injuries (MDRPIs)". I hope your study will provide new insights and contribute the advancement of knowledge and evidence. Furthermore, I would like to emphasize the importance of adhering to the ethical guidelines set forth by the hospital throughout the research process.

On behalf of An-Najah National University Hospital, I extend my best wishes and support for your research endeavors.

Sincerely,

Sa'ed H. Zyoud, Ph.D.
Clinical Toxicology
Director of Clinical Research Center

CC:
Chief Medical Officer
Chief Nursing Officer

الإدارة الطبية
Medical Management

Note: this approval letter is not valid unless signed and stamped by the CRC and the Chief Medical Officer of An-Najah National University Hospital

Appendix M

Educational Program Invitation Samples

Hosting a workshop under the title Medical device-related pressure injuries Inbox x

Continuing Education Center - NNUH <cne.nnuh@najah.edu> Feb 18, 2025, 11:43 AM

to Maher, yasmeen, Mohamad, Wala', Ahmad, Rana, Jehan, Alaa, Mohammad, Shadi, Waad, Yehia, Mo'Men, Ahmed, Shreen, Moath, Moath, Tasneem, Rae'F, Yasmeen, Anas, Omar, Yehia, Ahmad, Abdelhadi, Zakaria, Amro, Mai, Raghad, Ibra

Dear Colleagues,

I hope you're having a wonderful day.

We're sending this email to let you know that we're hosting a workshop under the title Medical device-related pressure injuries," and so you're invited to attend this workshop

on Wednesday, 26/2/2025, from [9:00] to [13:30], Place: "Student Clinical Training Building-Lab B.".

Consider your department's conditions and schedules . The priority will be for those who register first.

If you are interested, please register through the following link: https://forms.gle/rAY3rHpfqVaVfeRq7

Invitation to Workshop on Medical Device-Related Pressure Injuries Inbox x

Continuing Education Center - NNUH Tue, Mar 4, 9:28 AM

to Maher, yasmeen, Mohamad, Wala', Ahmad, Rana, Jehan, Alaa, Mohammad, Shadi, Waad, Yehia, Mo'Men, Ahmed, Shreen, Moath, Moath, Tasneem, Rae'F, Yasmeen, Anas, Omar, Yehia, Ahmad, Zakaria, Amro, Mai, Raghad, Ibrahim, Ahmad

Dear Colleagues,

I hope you're having a wonderful day.
We are pleased to invite you to attend a workshop titled "Medical Device-Related Pressure Injuries."

📅 Date & Time:
Wedensday, March 12, 2025
9:00 AM – 1:00 PM

I AM PLEASED TO INVITE YOU TO ATTEND THE EDUCATIONAL PROGRAM.

Medical device-related pressure injuries; Understanding Prevention and Management.

FEBRUARY

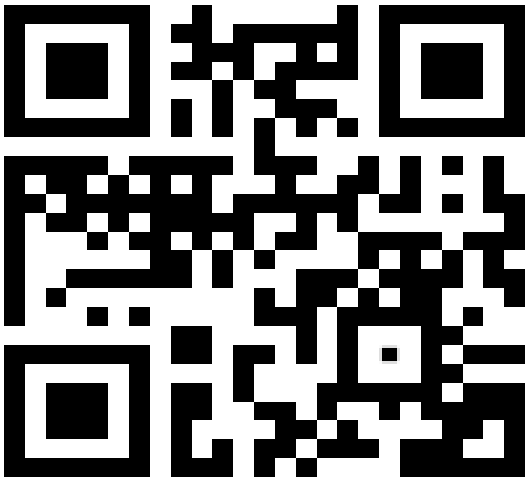
WEDNESDAY **26** **AT 9:00 AM TO 1:30 PM**

Student Training Center -
An-Najah National
University Hospital

Suhaila kharousheh

Appendix N

QR code regarding to consent form



Appendix O

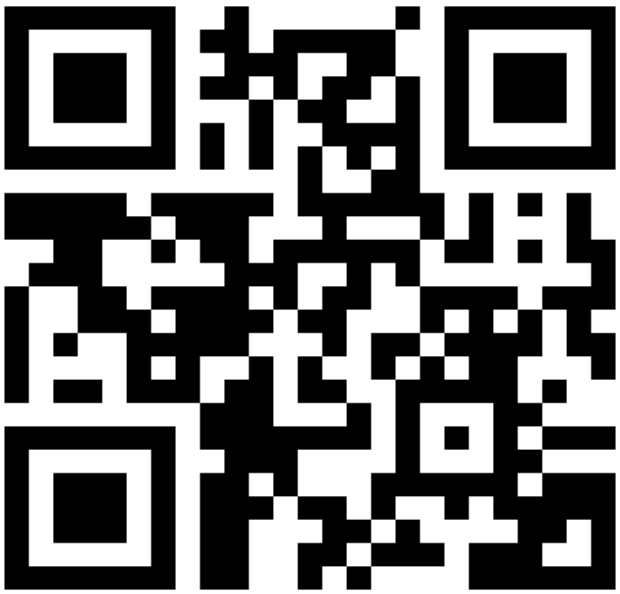
Educational Program Participation Details and Participant Anonymization Process

Appendix P

The Questionnaire (pre-test) QR

Appendix Q

The Questionnaire (post- test) QR



جـامعـــة النجاح الوطنية
كليـــة الدراســـات العليـــا

فعالية استخدام البرنامج التعليمي في تحسين معرفة ممرضي العناية المركزة للوقاية من إصابات الضغط الناتجة عن الأجهزة الطبية

إعداد
سهيلة خروشة

إشراف
د. عائدة القيسي

قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجة الماجستير في تمريض العناية المكثفة، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس– فلسطين.

2025

فعالية استخدام البرنامج التعليمي في تحسين معرفة ممرضي العناية المركزة للوقاية من إصابات الضغط الناتجة عن الأجهزة الطبية

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إشراف

د. عائدة القيسي

الملخص

الخلفية: تحدث إصابات الضغط المرتبطة بالأجهزة الطبية نتيجة استخدام الأجهزة المصممة والمطبقة لأغراض تشخيصية أو علاجية و الإصابة الناتجة عن الضغط تتوافق عمومًا مع نمط أو شكل الجهاز.

الهدف: تهدف الدراسة إلى تقييم فعالية البرنامج التعليمي في تعزيز معرفة ممرضي العناية المركزة بشأن الوقاية من إصابات الضغط المرتبطة بالأجهزة الطبية (MDRPIs).

التصميم: تم استخدام تصميم بحث شبه تجريبي لتقييم مستويات معرفة ممرضي العناية المركزة قبل وبعد البرنامج التعليمي.

البيئة التي أجريت فيها الدراسة: تم إجراء الدراسة في وحدات العناية المركزة المختلفة في مستشفى جامعة النجاح الوطنية (NNUH) في نابلس، فلسطين.

المشاركون: شارك في الدراسة ما مجموعه 74 ممرضًا في وحدات العناية المركزة.

الأدوات: تم جمع البيانات باستخدام أداتين رئيسيتين: 1. تم استخدام استمارة التمريض لجمع البيانات المهنية والديموغرافية. استبيان ذاتي يسمى استبيان معرفة إصابات الضغط المرتبطة بالأجهزة الطبية (MDRPI-KQ) قام بتقييم معرفة ممرضي العناية المركزة وفهمهم لإصابات الضغط المرتبطة بالأجهزة الطبية والإجراءات الشائعة المختلفة لمنع حدوثها.

النتائج: ارتفع مستوى معرفة طاقم التمريض من 68.2% قبل البرنامج إلى 94.9% بعد البرنامج. مظهراً مدى قيمة التحسن في فهم الموظفين في جميع الفئات، والتي تشمل المعرفة، وعوامل الخطر، والتصنيف، والوقاية، والعلاج.

الخاتمة: تم إثبات أن برنامج تدريب الوقاية والإدارة لمتلازمة الضغط المتعدد (MDRPI) كان أداة ناجحة لرفع وعي ممرضي العناية المركزة ومعرفتهم بالمشكلة، بالإضافة إلى تزويدهم بتقنيات وخبرات حديثة قائمة على الأدلة.

التوصية: يُنصح بوجود برامج تعليمية مستمرة للموظفين بشأن MDRPI. تشجيع الممرضين على المشاركة في الندوات والمؤتمرات وورش العمل حول MDRPI. يجب على المستشفيات تطوير سياسات محددة تغطي تسجيل وتوثيق وعلاج الإصابات الناتجة عن الأجهزة الطبية وإجراء دراسات مماثلة على عينة كبيرة.

الكلمات المفتاحية: برنامج تعليمي؛ معرفة ممرضي العناية المركزة؛ إصابات الضغط المرتبطة بالأجهزة الطبية (MDRPIs)؛ الوقاية من إصابات الضغط.