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Literature Review

A Systematic Review of Pressure Ulcers Prevention

Erna Dwi Wahyuni^{1*}, Yulis Setiya Dewi¹, Nadia Rohmatul Laili¹, Ninuk Dian Kurniawati¹, Sartika Wulandari², Gunawan Gunawan³, and Diah Lestari³

¹Faculty of Nursing, Universitas Airlangga, Surabaya, East Java, Indonesia

²Universitas Airlangga Hospital, Surabaya, East Java, Indonesia

³PHC Hospital, Surabaya, East Java, Indonesia

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CORRESPONDING AUTHOR

Erna Dwi Wahyuni _
erna-d-w@fkn.unair.ac.id
Faculty of Nursing, Universitas Airlangga, Surabaya, East Java, Indonesia

ABSTRACT

Introduction: Pressure ulcers in high-risk patients are contributes to patient burden and cost financially. Identifying strategies on the prevention of high ulcers among those with high risk is necessity. Nevertheless, an intense study exploring those issues is scarce. The study aimed to analyze the prevention method and their effectiveness in pressure ulcer prevention.

Method: This study used PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) to guide the systematic review process. The article searches were conducted on Web of Science (WOS), ScienceDirect, Wiley Online Library, and Scopus using the keywords used Decubitus Ulcer, Pressure Ulcer, Management, and Prevention, and any possible combinations.

Results: A total of 18 studies met the inclusion criteria for this review and show some different prevention for a pressure ulcer. The findings of the present study are foam dressings, support surfaces, repositioning, topical-based interventions, wearable patient sensors, and two distinct endotracheal tube fixations affect the incidence of pressure ulcers.

Conclusions: This current review emphasized a bundle care consisted of two methods or more are effective to reduce the incidence of pressure ulcers rather than a single treatment. Nurses should consider intervention to prevent ulcers among high-risk patients by way analyses of each single treatment prior bundling. Further study investigating factors associated wound's ulcer healing is necessary.

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1. INTRODUCTION

A pressure ulcer is one of the major challenges in hospitals; which endangers patient safety, prolongs hospital stay, and contributed to disability and death (Getie, Baylie, Bante, Geda, & Mesfin, 2020). Pressure ulcer affects around 10–30% of hospitalized patients worldwide and contributes to significant patient burden and healthcare costs (Roberts et al., 2017). Pressure ulcers (i.e. bedsores, pressure sores, pressure injuries, decubitus ulcers) are localized

cellular damages to the skin and underlying tissues caused by pressure, shearing, and frictional force (Berihu, Wubayehu, Teklu, Zeru, & Gerensea, 2020; McInnes et al., 2015). Pressure ulcers are serious and potentially life-threatening problems across all age groups and all medical specialties and care settings. They are common in the elderly and immobile, and costly in financial and human terms (McInnes et al., 2015; Wung Buh, Mahmoud, Chen, McInnes, & Fergusson, 2021). Moreover, pressure ulcers often become chronic wounds that are difficult to treat and

that tend to recur after healing (Mervis & Phillips, 2019). Pressure ulcers have a profound impact on individuals, with studies demonstrating that compared with similarly aged persons, those living with a pressure ulcer have a significantly lower quality of life (Shanley et al., 2022).

The development of a pressure ulcer is associated with external factors such as pressure, shear stress, and friction and internal factors such as age, general condition, skin condition, and nutritional status. Pressure ulcers typically develop over bone protrusions, which are most pressured by weight, but may also be caused by external pressure by medical devices or other objects applied to the patient. This tissue damage is caused by continuous deformation of the tissue due to the pressure acting perpendicular to the tissue surface and shear stress acting parallel to the tissue, either alone or in combination. Limitation of activity and mobility, skin condition, blood circulation and oxygen saturation, nutrition, humidity, body temperature, age, low pain sensitivity, blood count, and general and mental conditions are the primary risk factors for pressure ulcers (Doh & Heo, 2021).

Prevention has been a primary goal of pressure ulcer research. Despite such efforts, pressure ulcers remain common in hospitals and the community. As pressure ulcers contribute to significant patient burden and increased healthcare costs, their prevention is a clinical priority (Mervis & Phillips, 2019; Roberts et al., 2017). Preventing pressure ulcers is an essential part of patient care and it is important to be aware of the best way to prevent them (Nadukkandiyil et al., 2021). Pressure ulcers have consistently resisted prevention efforts in long-term care facilities nationwide (Tracey L. Yap, Kennerly, Bergstrom, Hudak, & Horn, 2016). Prevention of pressure ulcers is one of the greatest healthcare challenges in terms of reducing patient harm (Blenman & Marks-Maran, 2017). Pressure ulcer prevention strategies are varied and include risk assessment and appropriate preventive care planning based on outcomes from this risk assessment (Shanley et al., 2022). Due to the relevance of this problem, many studies have been done to ameliorate some aspects of pressure prevention and monitoring.

Studies related to pressure ulcer prevention and its effectiveness in reducing incidents of pressure ulcers have been conducted. Along with the development of science and the advancement of technology, pressure ulcer prevention methods have been developed and applied in hospital protocol or standard care. An important first step in identifying specific strengths and areas of need to ascertain the supports that may be required to establish preventative pressure ulcers were seen as gaining a more comprehensive understanding of the preventive method used by hospitals.

The purpose of the present study is to examine preventive methods used in reducing pressure ulcers and their effective preventive outcomes. The study

addressed the following research questions to guide the study, which interventions have been addressed in the literature? And What impacts do the preventive method in pressure ulcer incidents?

This study contributes to the literature in the recognition of method development in pressure ulcer prevention. The study is required to understand better how prevention method development affects the incidents of pressure ulcers.

2. METHODS

2.1 Literature Research

A secondary study with a systematic review design was chosen to answer the research questions. The present study examines the evidence from empirical studies that were published between 2018 and 2022 regarding interventions used in decubitus ulcer prevention and their effectiveness.

Various studies on decubitus ulcer prevention were previously investigated to uncover comparable and similar study themes. This made it possible to designate a comprehensive and in-depth study overview. In December 2022, article searches were conducted on the following database: Web of Science (WOS), ScienceDirect, Wiley Online Library, and Scopus, using the keywords used were Decubitus Ulcer, Pressure Ulcer, Management, and Prevention and any possible combinations. We also review the reference list for a wider coverage.

2.2 Study Selection and Data Analysis

All of the search results were organized in Mendeley Desktop and examined to see if they met the criteria for inclusion. Results that matched research papers exactly or did not were discarded. 1.356 studies were obtained from the databases during the initial search. The duplicates were then eliminated. The articles' titles and abstracts were then screened. The articles were taken into consideration and assumed relevant for the review if they met the criteria. The remaining 1.020 studies were then reduced to only empirical (experimental and explanatory design) publications. The title and abstract screening were then used to evaluate how well the article's content matched the wording of the generated research topic.

The remaining articles were subjected to a full-text screening to determine which publications qualify for review. To assure relevance to the goal of the investigation, a relevance criterion was determined using PICOS as shown in Table 1.

In the end, 18 articles retracted from the databases were included in the review. The authors' guide according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) updated guidance standards when conducting the review (Page et al., 2021). The literature's selection process are shown in Figure 1.

Table I. Inclusion and exclusion criteria

PICOS	Inclusion Criteria	Exclusion criteria
Patients	Inpatients hospital, on bed rest, and older adults	Children and outpatients in hospital
Interventions	Topical prevention for decubitus ulcer or any other prevention	Any indirect interventions, such as education and knowledge
Comparators	No comparators	No comparators
Outcomes	Reduce decubitus ulcer in patients	Studies focus on health workers
Study design	Experimental designs, quasi-experimental designs, and observational-analytical designs	Qualitative study, feature study, and reviews
Publication Type	Studies published in English in databases chosen from 2018 – 2022 and open access	Single site reports, duplicate publications of the same study

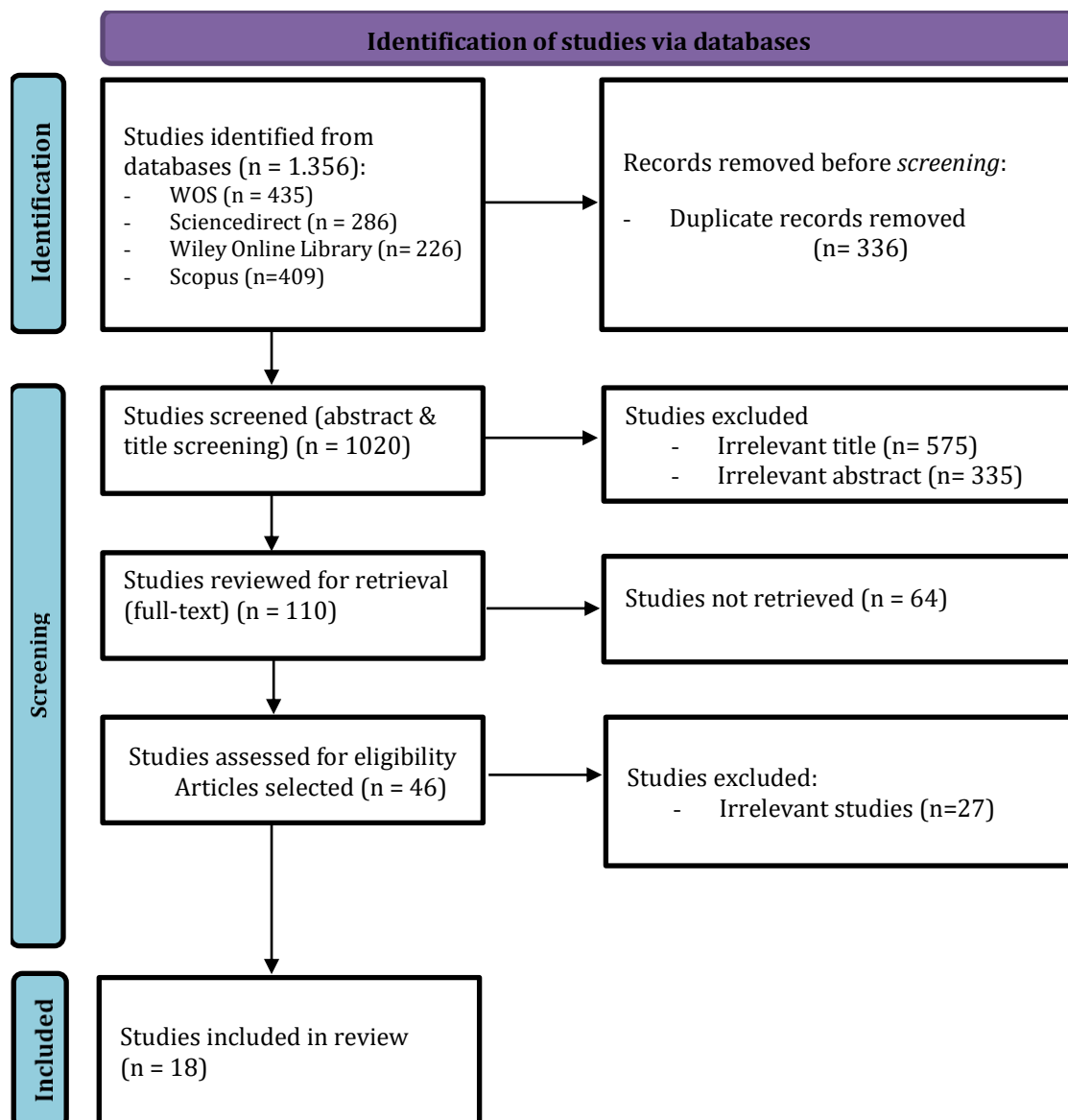


Figure 1 Literature's selection process using PRISMA

3. RESULTS

The authors included 18 studies used published between 2018 and 2022 for the data synthesis. The selected studies list by title, author, years of publication, study design, intervention, and outcome. All the articles reviewed in the present study consist of interventions or procedures to prevent the incidents of pressure ulcers, and all the articles used experimental research design. The article's design studies consist of a randomized controlled trial (n = 9), randomized clinical trial (n= 6), case series (n=1), comparative study (n=1), and pilot study (n=1). The participants of the study were high-risk adult inpatients in the hospital. The reviewed articles are shown in Table II (appendix).

3.1 The Intervention Used in The Literature

All of the articles reviewed combine the standard care for pressure ulcer prevention in hospital protocol with the interventions that have been addressed in the study. The interventions were analyzed and organized according to the type. This process enabled us to recognize the intervention type and the strategy used in the literature. This identification process resulted in some prevention methods, as shown in Table 2.

3.1.2 Foam dressings

Of the study analyzed, six studies explain how well pressure ulcer prevention using foam dressings. Five of six studies used silicone adhesive multilayer foam dressings to reduce the incidence of pressure ulcers of category 2 or worse in hospitalized at-risk patients. Article number [1] shows a decrease in the sacrum but there was no difference in the heel and trochanter areas. But, article number [3] and [4] show the application of foam dressings are effective in preventing pressure ulcers at the heels, sacrum, and coccyx. The intervention was done in addition to standard prevention for articles number [1], [2], [3], and [4]. While article number [5] was done combining foam dressing and medical devices to improve the efficiency of hospital treatment. Article number [6] used LimpiAD foam to control pressure ulcer onset by preservers or stimulating the healthy assembling of the skin microbiota which was found to be an innovative strategy to prevent pressure ulcers in high-risk patients.

3.1.2 Support surfaces

Four studies were conducted using surfaces to prevent pressure ulcers. Articles number [7] and [8] was using a viscoelastic mattress as a bedding surface and compared it to a standard hospital mattress covered with a pyramidal overlay and powered air pressure redistribution mattress. The results show viscoelastic support surfaces combined with standard prevention care reduced the incidence of pressure ulcers in high-risk patients. Articles number [9], [10],

and [11] was using alternating pressure mattresses (APM). Compared to high-specification foam (HSF) there was no statistically significant difference but APM can safely and reliably be used during neurological surgery to prevent pressure ulcers. Combining APM and gel pad have the potential effectiveness in preventing pressure ulcer formation in patients undergoing prolonged surgery.

3.1.3 Repositioning

Articles number [12] and [13] show the efficacy of repositioning in pressure ulcers. The efficacy of the application of changes in posture and complications related to it. Repositioning frequency are related to pressure ulcer incidence and medical severity.

3.1.4 Topical-based interventions

Three studies used topical-based intervention as their strategy. Topical-based intervention reviewed in the present study consists of Aloe Vera gel ([14]), Lawsonia inermis (henna) ([15]), and Olive Oil ([16]). In an article [14], they compared Aloe Vera gel and placebo. The result showed using Aloe Vera gel to prevent a rise in temperature, non-branch-able redness, swelling, and pain are recommended. The combination of standard prevention care and henna for high-risk patients developing ulcers is recommended as an inexpensive method. Compared to hyper oxygenated fatty acid, olive oil solution reduce the incidence of pressure ulcer and effective method to prevent pressure ulcer.

3.1.5 Other interventions

Other interventions reviewed in the present study were using wearable patient sensors [17] and two distinct endotracheal tube fixations [18]. The results show that wearable patient sensors increase the total time with turning compliance and demonstrated a significant effect on pressure ulcer incidence. Compared to the ETT method, the bandage method showed a better score in pressure ulcer risk along with the pressure ulcer scale for healing.

4. DISCUSSION

documentation audits by the quality committee and head of the room can also assist in monitoring the quality of documentation regularly. Evaluation of nursing care standards with the implementation of 3S as well as regular implementation of 3S evaluations by the head of space and PPJA will assist in ensuring that standards continue to be met.

This part was developed to address the research questions posed at the outset of the study while taking the findings into account. The findings of the present study are foam dressings, support surfaces, repositioning, topical-based interventions, wearable patient sensors, and two distinct endotracheal tube fixations that affect the incidence of pressure ulcers. Positive effects were also found regarding wound

healing. A major factor influencing the methods and results of pressure ulcer prevention was done standard care combine with good support surfaces, dressings or topical-based interventions, and software or hardware approaches. Evidence suggests that patient outcomes can be improved and adverse events reduced through the use of multi-component interventions, or care bundles and patient participation in care (Roberts et al., 2017).

Pressure ulcers are serious, avoidable, costly, and common adverse outcomes of healthcare. Pressure ulcers constitute a health issue that has a high prevalence and incidence rate in acute and long-term care, requiring long-term nursing care for treatment and prevention (Sengul & Karadag, 2020; Whitty et al., 2017). The number of pressure ulcer patients is increasing owing to the aging population and increased incidence of elderly illness. The hospitalized elderly population is the most common group to develop pressure ulcers (Doh & Heo, 2021; Wung Buh et al., 2021). Pressure ulcers are a critical issue not only for patients, decreasing their quality of life but also for healthcare professionals, contributing to burnout from continuous monitoring, with a consequent increase in healthcare costs (Silva et al., 2022). Pressure ulcers impose a substantial financial burden. The need for high-quality health care while expenditures are constrained entails the interest to calculate the cost of preventing and treating pressure ulcers and their impact on patients, healthcare, and society. The cost of pressure ulcer prevention and treatment differed considerably between studies. Although the cost to provide pressure ulcer prevention to patients at risk can importantly impact health care services' budgets, the costs to treat a severe pressure ulcer were found to be substantially higher (Demarré et al., 2015).

Data regarding pressure ulcer prevention practices are very important to take action (Getie et al., 2020). Cornerstones of effective prevention strategies include the use of appropriate support surfaces, frequent repositioning, proper nutrition, and moisture management can reduce the incidence of pressure ulcers (Mervis & Phillips, 2019). In addition to reducing the duration of pressure via frequent repositioning, minimizing pressure magnitude is essential. Pressure-relieving support surfaces (i.e. beds, mattresses, seat cushions, etc) are used to help prevent ulcer development. The study found that alternating-pressure mattresses may be more cost-effective than alternating-pressure overlays in a UK context. Pressure-relieving overlays on the operating table reduce postoperative pressure ulcer incidence, although two trials indicated that foam overlays caused adverse skin changes (McInnes et al., 2015; Mervis & Phillips, 2019). Specialized support surfaces, including mattresses and overlays, are designed to reduce pressure and minimize shear. Constant low-pressure and alternating-pressure supports reduce the incidence of pressure ulcers compared with standard mattresses (Mervis & Phillips, 2019). Another study explained anemia

correction, high protein diet supplementation, 2 h repositioning, and a mattress and cushion are the best practices for the management of pressure ulcers. Hence, these best practices are recommended for the early prevention of pressure ulcers among the elderly (Doh & Heo, 2021; Nadukkandiyil et al., 2021).

Topical protective agents should be used to protect the skin from moisture. Dressings, including films, hydrocolloids, and foams, have been used prophylactically to prevent skin damage. These dressings may minimize the effects of friction or shear on at-risk body surfaces. Prophylactic dressings can reduce the effects of friction and shear. Dressings can also protect intact skin from maceration. Fatty acid creams may reduce the incidence of pressure ulcers. Other topicals containing various "active" ingredients, such as silicone, dimethyl sulfoxide, zinc, and others, have been tried with little or even detrimental effect (Doh & Heo, 2021; Mervis & Phillips, 2019). There is no firm clinical evidence at this time to suggest that one dressing type is more effective than other dressings (Clark et al., 2014).

Sufficient nutrition may help prevent wounds in patients who are susceptible to pressure ulcers. Furthermore, early screening, individualized management of posture, and regular skin and nutrition monitoring are essential to prevent pressure ulcers (Doh & Heo, 2021). Pressure ulcer prevention training for health workers should include practical demonstrations of repositioning. Clear guidance regarding the optimal repositioning technique for pressure ulcer prevention is needed due to Turn angles decreased following the guidance, but offloading of body sites vulnerable to pressure damage remained sporadic (Woodhouse, Worsley, Voegeli, Schoonhoven, & Bader, 2019).

5. CONCLUSION

The findings of the present study are foam dressings, support surfaces, repositioning, topical-based interventions, wearable patient sensors, and two distinct endotracheal tube fixations that affect the incidence of pressure ulcers. The present study concludes that effective prevention of pressure ulcer methods varies. But, the use of a prevention care bundle (two methods or more) are effective to reduce the incidence of pressure ulcers. This systematic evaluation indicates that the prevention pressure ulcer method represents an important and developing research topic.

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Table II. Feature of reviewed studies

No.	Title, Author(s) & Year	Study Design & Participants	Intervention	Outcomes
1	Silicone adhesive multilayer foam dressings as adjuvant prophylactic therapy to prevent hospital-acquired pressure ulcers: a pragmatic noncommercial multicentre randomized open-label parallel-group medical device trial (Beckman et al., 2021)	Randomized controlled trial n= 1633 at-risk adult patients	<ol style="list-style-type: none"> 1. Standard hospital protocols 2. Silicone adhesive multilayer foam dressings 	Silicone foam dressings reduce the incidence of PUs of category 2 or worse in hospitalized at-risk patients when used in addition to standard of care. The results show a decrease for the sacrum, but no statistical difference for the heel and trochanter areas.
2	Effectiveness of a multi-layer silicone-adhesive polyurethane foam dressing as prevention for sacral pressure ulcers in at-risk in-patients: Randomized controlled trial (Forni et al., 2022)	Randomized controlled trial n= 709 in-hospital patients	<ol style="list-style-type: none"> 1. Standard preventive care 2. A multi-layer silicone-adhesive polyurethane foam dressing 	A sacral multi-layer silicone-adhesive polyurethane foam in addition to standard preventive care is effective for pressure ulcers prevention in at-risk hospitalized patients admitted to medical and surgical units
3	The effectiveness of two silicone dressings for sacral and heel pressure ulcer prevention compared with no dressings in high-risk intensive care unit patients: a randomized controlled parallel-group trial (Hahnel et al., 2020)	Randomized controlled two-arm superiority pragmatic study n= 422 patients	<ol style="list-style-type: none"> 1. PU prevention hospital standard 2. Two silicone dressings 	The results indicate that the application of dressings, in addition to standard prevention, in high-risk intensive care unit patients is effective in preventing pressure ulcers at the heels and sacrum.
4	Effects of Multilayer Silicone Foam Dressings for the Prevention of Pressure Ulcers in High-Risk Patients: A Randomized Clinical Trial (Oe, Sasaki, Shimura, Takaki, & Sanada, 2020)	Randomized clinical trial n= 600 hospitalized patients	<ol style="list-style-type: none"> 1. Standard care 2. Multilayer silicone foam dressings 	Multilayer silicone foam dressings can prevent pressure ulcers of the sacrum and coccyx in patients with persistent severe diarrhea and/or fragile skin
5	IOT Medical Device-Assisted Foam Dressing in the Prevention of Pressure Sore during Operation (Meng, Zhao, Yin, & Qi, 2021)	Randomized controlled trial n= 200 inpatients	<ol style="list-style-type: none"> 1. Traditional prevention 2. Foam dressing 3. IOT medical device 	IOT medical devices can improve the efficiency of hospital treatment and improve the efficiency by about 12%; foam dressing has an obvious effect on the prevention of pressure sore, and the probability of pressure sore after using foam dressing is lower than that of unused 35%. It indicates that foam dressing can play a key role in the prevention of pressure sore.
6	LimpiAD foam and the potential control of the pressure ulcers onset (Pietrangelo et al., 2021)	Single-centre pilot study n= 15 high-risk patients	<ol style="list-style-type: none"> 1. LimpiAD foam 	There are no significant differences between before and after treatment microbiotas but the microbial pattern caused by the application of LimpiAD foam

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				is considered at any taxonomic level. LimpiAD foam preservers or stimulates the healthy assembling of the skin microbiota. Therefore, LimpiAD is great potential ad an innovative strategy to prevent pressure ulcers in high-risk patients
7	The Effect of Support Surfaces on the Incidence of Pressure Injuries in Critically Ill Patients: A Randomized Clinical Trial (de Camargo et al., 2018)	Randomized clinical trial n= 62 patients	<ol style="list-style-type: none"> 1. Standard prevention of pressure injuries 2. Viscoelastic mattress as a bedding surface 3. Standard hospital mattress covered with a pyramidal overlay 	Pressure injuries occurred in 35 patients, with a median time of 7 days (ITQ 4–10) from admission. The frequency of pressure injuries was higher in the control group (80.6%) compared to the intervention group (32.2%; p < 0.001). Conclusions, Viscoelastic support surfaces reduced the incidence of pressure injuries in moderate or higher-risk critically ill patients when compared to pyramidal support surfaces.
8	A Multicenter, Comparative Study of Two Pressure-Redistribution Mattresses with Repositioning Intervals for Critical Care Patients (Jiang et al., 2020)	Multicenter open-label comparative study n= 1.204 patients	<ol style="list-style-type: none"> 1. Repositioning and viscoelastic foam mattress 2. Repositioning and powered air pressure redistribution mattress 	The 4-hour repositioning interval combined with a viscoelastic foam mattress did not increase PI incidence or risk. The difference between the two groups was significant (0.3% vs 1.8%). However, the difference between the groups' Braden Scale score median during the intervention was not significant (13 vs 13.5).
9	Pressure relieving support surfaces for pressure ulcer prevention (PRESSURE 2): Clinical and Health Economic Results of a Randomised Controlled Trial	Randomized controlled trial n= 2029 high-risk patients	<ol style="list-style-type: none"> 1. Alternating pressure mattresses (APM) 2. High-specification foam (HSF) 	The point estimate of the hazard ratio suggests a benefit of APM over HSF but the trial was underpowered for the primary 30-day post-treatment phase endpoint due to the low number of PU events and the time-to-event difference observed was not statistically significantly different between mattress groups.
10	Alternating Pressure Overlay for Prevention of Intraoperative Pressure Injury (Joseph, McLaughlin, Darian, Hayes, & Siddiqui, 2019)	Prospective case series with historical controls n= 100 patients	<ol style="list-style-type: none"> 1. Alternating pressure used during surgery 	Study findings suggest that the AP overlay system can safely and reliably be used during neurological surgeries. Findings further suggest that using the AP product may improve

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				outcomes concerning perioperative HAPIs, including patients deemed at high risk for pressure injury development.
11	Frequency of repositioning for preventing pressure ulcers in patients hospitalized in ICU: protocol of a cluster randomized controlled trial (Cortes et al., 2021)	Randomized controlled trial n= 3300 patients	1. A high-frequency level repositioning	The PENFUP-phase 2 project intends to advance the knowledge of efficacy in interventions oriented to preventing PUs in adult patients hospitalized, in this case in the investigation of the efficacy of the application of changes in posture and any complications related to frequent postural changing.
12	TEAM-UP for quality: a cluster randomized controlled trial protocol focused on preventing pressure ulcers through repositioning frequency and precipitating factors (T L Yap et al., 2018)	Randomized controlled trial n= 951 patients	1. NH-wide repositioning interval	This study will advance knowledge about repositioning frequency and clinically assessed PrU risk levels concerning PrU incidence and medical severity. The outcomes of this research will contribute to future guidelines for more precise preventive nursing practices and refinement of PrU prevention guidelines
13	The effect of Aloe Vera gel on prevention of pressure ulcers in patients hospitalized in the orthopedic wards: a randomized triple-blind clinical trial (Hekmatpou, Mehrabi, Rahzani, & Aminiyan, 2018)	Randomized triple-blind clinical trial n= 80 patients	1. Pure aloe vera gel used on a certain area 2. Placebo (gel of water and starch)	Due to the effect of Aloe Vera gel to prevent a rise in temperature, non-branchable redness, swelling, and pain of the skin of regions under study in hospitalized patients in the orthopedic ward, applying it toward the prevention of pressure ulcers in patients at risk of pressure ulcer development is recommended.
14	A randomized controlled trial to compare the interface pressure of alternating pressure overlay with gel pad versus gel pad alone during prolonged surgery (Neo et al., 2021)	Randomized controlled trial n= 180 patients	1. Alternating pressure (AP) overlay and gel pad 2. Only gel pad	The lower interface pressure (IP) during deflation cycles of the AP overlay (with gel pad) suggests its potential effectiveness in preventing pressure ulcer formation in patients undergoing prolonged surgery.
15	Henna (Lawsonia inermis) as an Inexpensive Method to Prevent Decubitus Ulcers in Critical Care Units: A Randomized Clinical Trial (Hekmatpou, Ahmadian, Eghbali, & Farsaei, 2018)	Randomized clinical trial n= 80 patients	1. Standard prevention care and henna	At the end of the study, 1 patient in the intervention group (2.7% male) and 6 patients in the control group (14.29% male, 2.85% female) had developed decubitus ulcers; this difference was significant (P $\frac{1}{4}$.001). In conclusion, for every patient

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				at risk of developing decubitus ulcers, the application of henna as a preventive measure is recommended.
16	Effectiveness and safety of olive oil preparation for topical use in pressure ulcer prevention: Multicentre, controlled, randomized, and double-blinded clinical trial (Diaz-Valenzuela et al., 2019)	Randomized controlled clinical trial n= 571 participants	<ol style="list-style-type: none"> 1. Hyperoxygenated fatty acid 2. Olive oil solution 	The pressure ulcer incidence was 4.18% in the olive oil group vs 6.57% in the control group, with an incidence difference of -2.39% (95% CI = -6.40 to 1.56%), which is within the pre-established non-inferiority margin of ±7%, thus supporting the study hypothesis.
17	Effect of a wearable patient sensor on care delivery for preventing pressure injuries in acutely ill adults: a pragmatic randomized clinical trial (LS-HAPI study) (Pickham et al., 2018)	Randomized clinical trial n= 1564 adult patients	<ol style="list-style-type: none"> 1. Turning care relying on traditional turn reminders 2. Standard practices 3. Optimal turning practices 4. Real-time data derived from a wearable patient sensor 	The provision of optimal turning was greater with a wearable patient sensor, increasing the total time with turning compliance and demonstrating a statistically significant protective effect against the development of hospital-acquired pressure injuries.
18	The impact of two distinct endotracheal tube fixation on the formation of pressure ulcer in the intensive care unit: A randomized controlled trial (Genc & Yildiz, 2022)	Randomized controlled trial n= 60 patients	<ol style="list-style-type: none"> 1. Endotracheal tube holder fixation 	Based on the Braden Scale scores of the patients, we found that 98.3% of the cases were in the high-risk group before and after the intervention. We also found that the recovery was higher among patients in whom the bandage fixation method was applied compared to those in whom the fixation was done with an endotracheal tube holder.