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Lateral Repositioning for Preventing Pressure Ulcers in Stroke Patients: A Systematic Review

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Abstract

Introduction: Pressure ulcers (PU) are a common complication among stroke patients, especially those with limited mobility. Proper nursing interventions, such as regular lateral repositioning, play a crucial role in preventing these injuries. However, the optimal angle and frequency of repositioning remain subjects of ongoing research. **Objective:** This systematic review aims to synthesize evidence on the effectiveness of various lateral positions and repositioning intervals in reducing the risk of PU in stroke patients. **Method:** This review follows PRISMA guidelines. Literature searches were conducted using databases such as PubMed, ScienceDirect, and Google Scholar, focusing on studies investigating lateral positioning interventions for stroke patients. Inclusion criteria consisted of studies published in English and Indonesian, with no publication year restrictions, covering any stroke subtype. We framed the research questions using PICO elements and analyzed the selected articles with the CASP checklist, classifying them based on levels of evidence and recommendation strength. **Results:** Seven studies were included in the final analysis, with four conducted in Indonesia and three from international sources. The findings indicate that a 30° lateral tilt is more effective than a 90° angle in preventing PU. Additionally, repositioning every 2–3 hours significantly reduces the risk, while repositioning every 3–4 hours presents a cost-effective alternative without increasing risk. An economic analysis highlighted substantial savings with repositioning every 3 hours compared to every 2 hours. **Recommendation:** Lateral repositioning at a 30° angle and 3–4-hour intervals provides an optimal balance between effectiveness and cost-efficiency in preventing PU among stroke patients. Further research with larger sample sizes and robust designs is recommended to strengthen the evidence base.

Keywords: lateral repositioning, nursing interventions, pressure ulcers, stroke

INTRODUCTION

Stroke is one of the leading causes of death and disability worldwide. Each year, over 15 million people experience a stroke, with approximately 5 million deaths and another 5 million suffering permanent disability (1,2). In Indonesia, the prevalence of stroke was recorded at 7 per 1.000 people in 2013, increasing to 10.9 per 1.000 people in 2018 (3). As stroke incidence rises, leading to higher disability rates, one of the most common outcomes is paralysis or weakness.

Damage to brain nerves that control body movement due to stroke often results in paralysis or weakness, particularly on one side of the body (hemiplegia or hemiparesis). This condition arises from disruptions in the corticospinal tract, which plays a vital role in transmitting motor signals from the brain's motor cortex to the spinal cord and, ultimately, to the body's muscles (4,5). Stroke patients, especially those with hemiplegia, are vulnerable to complications such as PU due to limited mobility (6). Immobility during the acute phase of stroke significantly increases the risk of PU if not addressed with proper interventions (7). his issue is a serious concern in managing stroke patients with paralysis or restricted movement, as it can further deteriorate their health if left untreated. Therefore, the role of nursing care is crucial in preventing PU.

PU are a serious complication frequently encountered by stroke patients. According to recent studies, the risk of developing PU in stroke patients increases significantly due to prolonged immobility, especially during the acute phase (7). Research shows that approximately 30% of stroke patients are at risk of developing PU during treatment (8). Another study indicates that 10%–18% of PU occur in care units, while 2.3%–28% occur in long-term care settings (9). These findings highlight the importance of proper nursing interventions and preventive measures to address PU effectively

providing the high risk and prevalence of PU in stroke patients, effective nursing interventions are essential to minimize these complications. While repositioning strategies are widely advocated, uncertainty remains regarding the most effective angles and intervals for stroke-specific care (10,11). Current evidence largely stems from general patient studies or non-specific care settings, leaving an unmet need for focused research on optimal repositioning for stroke patients. This systematic review aims to fill that gap by evaluating evidence on lateral positioning techniques and repositioning intervals tailored to stroke patients, offering evidence-based guidance for effective PU prevention in this vulnerable population.

OBJECTIVE

This systematic review seeks to compile evidence on the impact of different lateral positions and repositioning intervals in minimizing the risk of PU among stroke patients

METHODS

In conducting this literature review, the search strategy followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (12). Literature searches were carried out using PubMed, ScienceDirect, CINAHL, Google Scholar, and secondary searches. The research questions were structured using the electronic PICO method (Patient, Intervention, Comparison, and Outcome) (13). The PICO elements for this study are as follows: P: Stroke patients at risk of PU, I: Lateral positioning, C: None, O: Reduced risk of PU. The search keywords, based on the MeSH Term database, are provided in Table 1.

Table 1: Description of Keywords Used in Literature Search with PICO Method

	PICO Components
P	*acute stroke OR cerebral stroke OR pressure ulcers OR pressure injury OR decubitus ulcers OR ulcers, decubitus*
I	*Nursing care management OR patient repositioning OR mobilization OR early mobilization OR lateral position OR sloping position*
C	*There is no comparison*
O	*Evaluate*

The research question, formulated using the PICO strategy, is as follows: "What is the appropriate position to prevent the risk of PU in stroke patients?" The inclusion criteria for

this EBN search are: (1) a focus on repositioning interventions to prevent PU, (2) articles written in English or Indonesian, (3) studies involving stroke patients of all ages, genders, or stroke subtypes, (4) intervention-based articles, and (5) no limitations on publication year to ensure a broad scope on repositioning effectiveness for stroke patients. This approach allowed us to consider relevant studies across various periods, providing a richer and more comprehensive evidence base.

The included articles were critically appraised using the Critical Appraisal Skills Programme (CASP) Checklists (Table 3) (14). The study selection considered the level of evidence, recommendation grade, and quality. The recommendation grade reflects the quality of the research and assists in interpreting recommendations based on the level of evidence. For analysing the quality of clinical studies, the Centre for Evidence-Based Medicine (CEBM) classification was applied, categorizing studies into five levels of evidence (1 to 5) based on study design and four recommendation grades (A, B, C, and D) (15).

The levels of evidence for therapeutic studies are structured as follows: Level 1A includes systematic reviews of RCTs with homogeneity. Level 1B consists of individual RCTs with narrow confidence intervals. Level 1C includes "all-or-none" studies. At Level 2A, evidence is derived from systematic observations with homogeneity from cohort studies. Level 2B consists of individual cohort studies, including low-quality RCTs, such as those with follow-up rates below 80%. Level 2C comprises outcomes research and ecological studies. Level 3A refers to systematic observations with homogeneity from case-control studies, while Level 3B includes individual case-control studies. Level 4 encompasses case series and low-quality cohort and case-control studies. Finally, Level 5 is based on expert opinions without explicit critical appraisal or those grounded in basic physiological research or fundamental principles (15). To ensure consistency in this classification, two reviewers independently assessed and assigned each study to the appropriate level of evidence. Discrepancies in classification were resolved through discussion or by consulting a third reviewer.

To control for potential bias in article selection, we applied strict inclusion and exclusion criteria and performed a two-step screening process, starting with titles and abstracts, followed by a full-text review. This method minimized selection bias and ensured that only studies meeting the rigorous criteria for relevance and quality were included. Potential conflicts of interest and funding sources were also documented to assess the risk of bias in each study.

RESULTS

Search Results and Study Selection

In the initial stage of our systematic review, an extensive search across multiple electronic databases yielded 1.662 potentially relevant articles. We then applied an algorithm to remove duplicates, records automatically flagged as ineligible by the search engine, and others excluded for various reasons. Subsequently, the titles and abstracts were rigorously evaluated against the pre-established inclusion and exclusion criteria. This process resulted in the selection of 23 articles for detailed analysis. Researchers thoroughly reviewed the full texts of these articles, leading to the exclusion of 16—9 were review articles, and 7 did not align with the research question. Ultimately, 7 articles met all criteria and were included in our final literature review(16–22). Figure 2 illustrates the study inclusion process.

Study Description

Of the seven articles reviewed, four were conducted in Indonesia using a quasi-experimental research design (17–20). Meanwhile, two studies from Ireland and one from Canada employed a RCT design (16,21,22).

Respondent Characteristics

The characteristics of respondents in the reviewed articles include ischemic and haemorrhagic stroke patients with varying age ranges. Most respondents were aged 51–60 years (17),31–65 years (19), ≥60 years (52.8%) (20), and 56–65 years (46.9%) (18). The majority of respondents were male in the studies by Sujatmiko, Latipah, and Meliza, while Sulistiyawati reported a majority of female respondents (17–20) . In contrast, the studies by Moore et al. (2011, 2013) and Paulden et al. (2014) focused on elderly patients in long-term care, with the majority being female (77.6%)

and an average age of 85.1 years reported in Paulden's study (16,21,22).

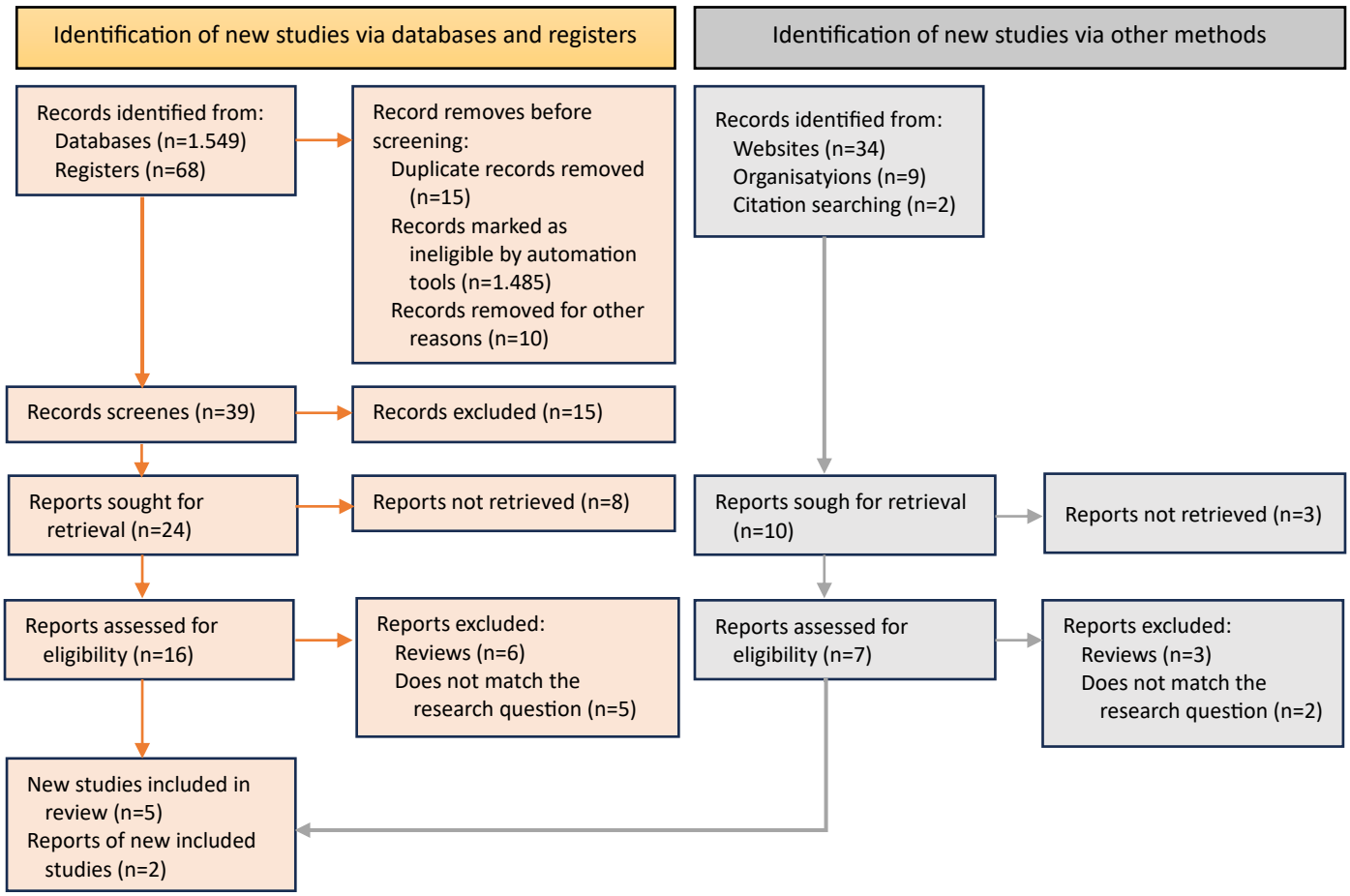

Figure 2: Flowchart of Study Selection and Inclusion (12)

Pressure Ulcer Instruments

All reviewed articles utilized the Braden Scale (16–22), an assessment tool for evaluating the risk of PU, consisting of six subscales: sensory perception, moisture, activity, mobility, nutrition, and friction/shear. Each subscale is scored numerically, with all except one rated from 1 to 4. A score of 4 indicates no issues in the specific subscale, while a score of 1 reflects significant problems. The friction and shear subscale is scored from 1 to 3. The total score ranges from 6 to 23, where lower scores indicate a higher predicted risk. The interpretation of the scores is as follows: 15–18 (low risk), 13–14 (moderate risk), 10–12 (high risk), and ≤9 (very high risk). In addition, Moore et al. incorporated two other measurement tools: the European PU Advisory Panel (EPUAP) and the Malnutrition Universal Screening Tool (MUST) (21,22). Furthermore, two studies also performed cost analyses related to the implemented interventions (16,21).

Repositioning Interventions to Prevent Pressure Ulcers

A lateral position with a 90° or 30° tilt has been found effective in reducing the risk of pressure ulcers ($P < 0.001$; level of evidence 2C) (19). Another study reported that mobilizing every 2 hours and applying olive oil twice daily can prevent PU in stroke patients ($P < 0.05$; level of evidence 2C) (18). Additionally, repositioning every 2–3 hours was shown to effectively reduce the incidence of PU ($P < 0.013$; level of evidence 2C) (17).

Further research found that 30° lateral repositioning every 2 hours is more effective than 90° repositioning at the same interval (level of evidence 2C) (20). Another study concluded that repositioning every 3 hours

with a 30° tilt is more effective than the standard 6-hour repositioning with a 90° tilt (level of evidence 1B) (22). Additionally, research revealed that repositioning every 3–4 hours is more cost-effective without increasing the risk of PU compared to the 2-hour interval (level of evidence 1B) (16).

Economic Analysis of Pressure Ulcer Prevention Interventions

Two studies addressed economic analysis (16,21). Moore et al. (2013) found that repositioning every three hours with a 30° tilt was more effective and cost-efficient compared to the standard six-hour repositioning with a 90° rotation. The daily nursing time required for the 30° repositioning was 18.5 minutes, with a per-patient cost of €20.6, whereas the 90° rotation cost €253.1. The cost per ulcer-free patient was €213.9 (30° tilt) and €287.3 (90° tilt). Annual projections for 588 patients across 12 sites showed a total cost of €1.59 million (30° tilt) and €2.10 million (90° tilt), resulting in savings of €510,000 and reduced nursing time (21). Another study found that repositioning frequency significantly impacts staff time and cost efficiency in preventing PU. Repositioning every 2 hours required 102.8 minutes of nursing time per day, while repositioning every 3 hours reduced the time to 68.5 minutes, and every 4 hours to 51.4 minutes. Transitioning from 2-hour to 3-hour repositioning saved 34.3 minutes of staff time per day, valued at $10.70, or $3,905 annually per patient. Repositioning every 4 hours saved 51.4 minutes, valued at $16.06, equivalent to $5,857 per year. In a facility with 123 patients, 41 of whom were at moderate or high risk, the economic benefit was $453 per day (3-hour repositioning) or $686 per day (4-hour repositioning). The total annual economic benefit was estimated at $104.5 million for 3-hour intervals and $158.4 million for 4-hour intervals (16).

DISCUSSION

Lateral repositioning is a crucial strategy for preventing pressure ulcers in stroke patients. Research indicates that positioning the patient at specific angles and applying repositioning at appropriate intervals can significantly reduce pressure on vulnerable areas while also minimizing long-term care costs.

Lateral Position and Its Effectiveness

A study found that lateral positioning at both 30° and 90° angles can reduce the risk of pressure ulcers in stroke patients, with a level of evidence rated at 2C (19). Similar research shows that a 30° lateral position is more effective than a 90° angle in alleviating pressure on bony areas prone to injury (20). However, other studies highlight inconsistent findings regarding the comparative effectiveness of these angles, with low evidence quality due to limitations in study design and minimal variation in the frequency of nighttime care (23). A case study suggests that angles between 30° and 45° are recommended as the optimal body positioning range to prevent pressure ulcers (24). Specifically, at a 30° angle, the pressure on the scapula is reduced, and pressure distribution is more even. Meanwhile, a 45° angle minimizes pressure on the sacrum, lowering the risk of skin damage in that area (24). hese findings confirm that a 30° inclination effectively distributes pressure more evenly, reducing the risk of developing pressure ulcers.

Several studies have also compared 30° and 90° angles to reduce pressure on vulnerable areas of the body. One reviewed study found that repositioning at a 30° angle every 3 hours was more effective than a 90° angle every 6 hours in preventing pressure ulcers (22). A randomized controlled trial (RCT) further demonstrated that peak pressure in the 90° position was significantly higher than in the 30° position. Specifically, at a 90° angle, pressure on the trochanter (hip area) consistently exceeded 60 mmHg throughout the measurement period. In contrast, pressure remained more stable under 60 mmHg at a 30° angle. Based on these findings, the study recommended changing positions every 1.5 hours for the 90° angle and every 2-3 hours for the 30° angle to effectively prevent pressure ulcers (25).

Repositioning Frequency, Nurse Workload, and Cost Efficiency

Optimal repositioning frequency has been a primary focus in several studies. Research shows that lateral repositioning every 2-3 hours effectively reduces the incidence of pressure ulcers in stroke patients, with a level of evidence rated at 2C (17). Another study found that extending repositioning intervals from 2 to 3 or 4 hours can significantly reduce care costs without increasing the risk of pressure ulcers (16). Additionally, research highlights that

repositioning every 3 hours at a 30° angle is more effective than repositioning every 6 hours at a 90° angle in preventing pressure injuries (22).

In addition to reducing the incidence of pressure ulcers, less frequent repositioning also eases the workload of nurses and decreases daily care time (21). One study reported that switching to repositioning every 3 or 4 hours can save up to $5,857 per patient annually while maintaining optimal care quality (16). he study further revealed that repositioning every 3 to 4 hours produces similar outcomes to repositioning every 2 hours, but with greater time and cost efficiency (16). Another study found that care costs per patient decreased by CAD 16.74 per day with 3- or 4-hour repositioning intervals, compared to the 2-hour schedule, without increasing the risk of pressure ulcers (26). However, the certainty of evidence remains low, indicating the need for further research to validate these findings.

CONCLUSION AND IMPLICATIONS

Repositioning is essential in preventing PU, particularly in patients with limited mobility, such as those with stroke. A 30° tilt with a 3-4 hour repositioning interval offers a more efficient approach, reducing nursing workload compared to 2-hour intervals. This study suggests practical changes in nursing practice, where a 3-4 hour repositioning schedule could improve patient care efficiency and reduce caregiver strain. Implementing this approach may help healthcare facilities optimize resources, reduce costs, and still uphold PU prevention standards. For future research, this study underscores the need to validate these findings across different healthcare settings and patient populations. Further evidence could support the establishment of standardized repositioning protocols, improving PU prevention outcomes universally.

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Table 3. Critical Appraisal

No	Critical appraisal Intervention studi (14)	Latipah et al (2024)	Meliza et al (2020)	Sujatmiko & Srihastuti (2023)	Sulistiyawati & Cahyati (2020)	Moore et al (2013)	Moore et al (2011)	Paulden et al (2014)
1	Did the trial address a clearly focused issue?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Was the assignment of patients to treatments randomised?	No	No	No	No	Yes	Yes	Yes
3	Were all of the patients who entered the trial properly accounted for in the conclusion?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Were patients, health workers and study personnel 'blind' to treatment?	No	No	No	No	Yes	Yes	Yes
5	Were the groups similar at the start of the trial?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Aside from the experimental intervention, were the groups treated equally?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	How large was the treatment effect?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	How precise was the estimate of the treatment effect?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Can the results be applied to the local population, or in your own context?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Were all clinically important outcomes considered?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Are the benefits worth the harms and costs?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Levels of Evidence for Therapeutic (15)		2C	2C	2C	2C	1B	1B	1B

Table 2. Description of Repositioning Interventions to Prevent Pressure Ulcers

Researcher, Country	Research Design	Aim	Sample Size	Intervention	Measuring instrument	Outcome
Latipah et al (2024). Indonesia	Quasi-experiment	To compare the effectiveness of 30-degree and 90-degree lateral positions in reducing the risk of pressure ulcers in stroke patients	22 responden	The control group was tilted at a 90-degree angle, while the intervention group was tilted at a 30-degree angle	Braden Scale	Lateral position interventions, both at 90-degree and 30-degree angles, have a significant impact on reducing the risk of pressure ulcers. Additionally, nutritional improvements play a crucial role in further minimizing this risk
Meliza et al (2020). Indonesia	Quasi-experiment	To identify the impact of mobilization and olive oil application in preventing pressure ulcers in stroke patients	64 respondents	Intervention Group: 1. Lateral positioning every 2 hours (right and left). 2. Olive oil applied twice daily for 10–15 minutes on areas prone to ulcers. 3. Intervention done for 7 days. Control Group: 1. Same lateral positioning every 2 hours without olive oil. 2. Intervention lasted 7 days	Braden Scale	Overall, the combination of mobilization (right and left lateral positioning) and twice-daily olive oil application helps maintain skin moisture, improve blood circulation, prevent irritation, and accelerate wound healing. This study recommends this technique as an effective strategy to prevent pressure ulcers in patients with prolonged immobility, such as stroke patients.
Sujatmiko & Srihastuti (2023), Indonesia	*Pre-experiment*	To determine the effect of positioning techniques on the occurrence of pressure ulcers in patients with ischemic stroke .	24 respondents	Lateral repositioning technique: Patients in this group are regularly repositioned every 2-3 hours	Braden Scale	Lateral repositioning, specifically at 2-3 hour intervals, has proven effective in reducing the incidence of pressure ulcers in immobilized stroke patients. The study shows that patients receiving regular repositioning interventions have a lower risk of developing pressure ulcers compared to those receiving standard care only
Sulistiyawati & Cahyati (2020), Indonesia	Quasi-experiment	To compare the effect of 30° and 90° lateral positions on the incidence of pressure ulcers in stroke patients.	34 respondents	Intervention Group: 1. Patients are positioned at a 30° angle to reduce pressure on bony areas. 2. Position changes every 2 hours. Control Group: 1. Patients are positioned at a 90° angle, fully on their side. 2. Position changes every 2 hours.	Braden Scale	The 30° lateral position is more effective in preventing pressure ulcers in stroke patients compared to the 90° position. The study shows that the 30° position reduces pressure on bony areas prone to ulcers, making it more optimal for preventing skin damage

Moore et al (2013). Ireland	RCT	To compare the incidence of pressure ulcers and the associated costs of repositioning elderly individuals in long-term care using two different repositioning regimens	213 respondents	Experimental Group: Participants are repositioned every three hours at a 30-degree angle. Control Group: Participants receive standard care with repositioning every six hours using a 90-degree lateral rotation	1. Nursing Time Calculation 2. Nurse Cost per Patient 3. Cost-Effectiveness Analysis 4. Annual Cost Calculation 5. Cost Savings	Repositioning every three hours at a 30-degree angle is a more effective and cost-efficient strategy than the standard six-hour repositioning with 90-degree rotation for preventing pressure ulcers in elderly patients in long-term care.
Moore et al (2011). Ireland	RCT	To assess the effect of three-hour overnight repositioning at a 30° angle on the incidence of pressure ulcers in elderly patients at risk of pressure ulcers in long-term care hospital settings	213 respondents	Experimental Group: Participants are repositioned every three hours at a 30-degree angle. Control Group: Participants receive standard care with repositioning every six hours using a 90-degree lateral rotation	1. European Pressure Ulcer Advisory Panel (EPUAP) 2. Braden scale 3. Malnutrition Universal Screening Tool (MUST)	The study results show that three-hour overnight repositioning at a 30-degree angle significantly reduces the incidence of pressure ulcers compared to the standard care of six-hour repositioning with 90-degree lateral rotation
Paulden et al (2014). Canada	RCT	To estimate the economic impact on Ontario of shifting from a 2-hour repositioning schedule to 3-hour or 4-hour intervals	942 respondents	Group 1: Repositioning every 2 hours Group 2: Repositioning every 3 hours Group 3: Repositioning every 4 hours	1. Braden scale 2. Cost Analysis	Adjusting the repositioning frequency from every two hours to every three or four hours offers significant cost-saving potential without increasing the risk of pressure sores in long-term care facility residents