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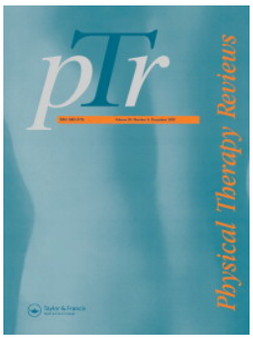

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Challenges and best practices during manual handling for patient positioning in long-term care settings: a scoping review

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ABSTRACT

Introduction: Healthcare practitioners (HCPs) are at risk of work-related musculoskeletal disorders (WRMSDs) due to manual handling, with associated staff shortages and reduced quality of healthcare. Whilst manual handling challenges for HCP's have previously been explored, there is a research-practice gap in handling during positioning. This scoping review maps challenges and practices in manual handling during patient positioning.

Method: This scoping review comprised (MEDLINE®, CINAHL, AMED, Scopus, Embase), and grey literature sources, including papers in English published from 1992 to 2025.

Results: Of 7,376 unique papers, 118 met the criteria for inclusion. Findings were categorized into injury-associated factors and optimized practices for safety. Repositioning and turning patients into side-lying were reported as the most frequent and challenging tasks compared to other positioning care (e.g. bed mobility,posture management). Available practices had limitations and did not completely remove the risk of excessive exertion from the HCPs. Studies recommended that using a system of low-tech handling devices and optimized techniques to support patient positioning in bed was pivotal to improving outcomes.

Discussion: Implementation of common positioning devices (e.g. slide sheet, hoist, pillows/wedges) has fallen short in significantly reducing the incidence of WRMSDs during patient positioning in bed. Emerging evidence supports integrated systems of low-tech handling devices, such as the in-bed sliding systems and wedges. However, further work is needed to quantify the biomechanical impact of these systems on the HCPs and patients.

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KEYWORDS
Patient manual handling; long-term care; bed mobility; posture management; work-related musculoskeletal disorder (WRMSD)

1. Introduction

Manual handling has been defined as 'the fine art of helping people to move without lifting them' [1]. The concept of patient manual handling aims to improve patient safety and reduce injury to healthcare practitioners (HCPs) [2], including work-related musculoskeletal disorders (WRMSDs) [3,4] during transfers, mobility, and positioning care. This led to the development and transition of practices from a very hands-on and HCP physical effort-oriented approach to increased integration of mechanical and friction-reducing equipment.

Challenges in implementing less physical effort in manual handling care have been highlighted through a multi-factorial framework that includes the task, individuals/HCPs, load/patient, environment, and others (TILEO) [5]. For instance, patient-related factors may include caring for individuals with limited physical capabilities [6], non-cooperative patients [7,8], and bariatric patients [9]. The HCP-related factors may include staff shortages [10,11], varying levels of knowledge, the implementation of accurate techniques, and psychosocial factors [12]. The environment-related factors may include challenging care settings, such as limited workspace in some residential care homes [13], and the availability and utilization of patient positioning aids [14].

While available devices and techniques have been shown to reduce fatigue, pain, and workplace frustration, most positive outcomes have been with the transfer and mobility aspects of patient manual handling [15,16]. For instance, a four-year and six-month retrospective review of injury records before and after the installation of an overhead lifting system in a hospital showed a significant reduction in injury rates occurring during lifting and transferring, whilst no change was seen during patient positioning [17]. No significant changes were noted in the prevalence of WRMSDs among HCPs who used mechanical lifts, as such devices did not effectively

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Table 1. Keyword search strategies for each of the selected databases.

Databases	Applied boolean search strategy	Records identified
Medline (with full text)	"Manual handling" OR "Physical work environment" OR "Moving and handling" OR pulling OR pushing OR supporting OR lifting OR lowering OR turning OR "Safe moving" OR "safe patient handling" OR "management around the bed" OR "personal care" OR "patient safety" AND "Patient positioning" OR Positioning OR prone OR "body position*" OR "Fowler's position" OR posture* OR bed OR pillows OR "hospital mattress" OR "Patient positioning system" OR "support surface" OR "bed making" OR "sleep posture" OR "positioning device" OR reposition* OR "bed mobility" OR "regular position*" OR supine OR "lateral position" OR "side lying" OR "pressure redistribut*" AND Challenges OR complications OR musculoskeletal* OR "work-related*" OR "safety at work" OR injury OR risk* OR paralysis OR contracture OR swelling OR ulcer OR pain NOT surg* OR anesthesia OR radio* OR covid* OR depression OR anxiety OR psych* OR pediatric* OR infant* OR pregnancy OR chair* OR sitting OR acute OR " Acute Respiratory Distress" OR infection OR industry OR sports OR athletes OR "construction work*" Advanced search Expanders - Apply equivalent subjects Search modes – Proximity	2,487
CINAHL Ultimate	Same as above	1,592
AMED	Same as above	155
Scopus	Same as above Limiting to English, Medicine, Engineering, Nursing, and Health Professions	4,668
Embase	Manual handling or Physical work environment or Moving or handling or pulling or pushing or supporting or lifting or lowering or turning or Safe moving or safe patient handling or management around the bed or personal care or patient safety AND Patient positioning or Positioning or prone or body position* or Fowler's position or posture* or bed or pillows or hospital mattress or Patient positioning system or support surface or bed making or sleep posture or positioning device or reposition* or bed mobility or regular position* or supine or lateral position or side lying or pressure redistribut* AND Challenges or complications or musculoskeletal* or work-related* or safety at work or injury or risk* or paralysis or contracture or swelling or ulcer or pain NOT surg* or anesthesia or radio* or covid* or depression or anxiety or psych* or pediatric* or infant* or pregnancy or chair* or sitting or acute or Acute Respiratory Distress or infection or industry or sports or athletes or construction work* Limiting to English, Full Text, Human, Remove MEDLINE Records	247

replace up to 50% of care needs [18]. This suggests that the usefulness of mechanical lifting systems may be questioned in situations where manual handling force may still be required (e.g. during the insertion and removal of hoist slings) [19–21].

Patient positioning in long-term care settings commonly includes care tasks such as bed mobility, repositioning, lateral turning, side-lying, posture, and personal care on bed [22,23]. Common positioning devices, such as the slide sheet, have been noted to still contribute to WRMSDs, as most sheets tested exceeded the recommended force threshold of the 15 kg lift limit [24–30]. This may be due to the sliding, pulling, pushing, and holding components inherent in many manual handling techniques, such as those involving sliding sheets [31–33]. The introduction of pressure redistribution mattresses to reduce the patients' risks of pressure injury has also been shown to reduce patient bed mobility and increase dependence due to the enveloping properties of these mattresses [34,35].

Whilst recent reviews of the literature have noted significant benefits from using mechanical and friction-reducing devices for lateral transfers and repositioning [36,37], some gaps were highlighted for tasks such as lateral turning and repositioning in bed [38]. Besides, these recent reviews adopted a generic focus on all aspects of patient handling. The limitations noted may begin to explain why available handling aids and safety programs have not effectively reduced the prevalence of WRMSDs among HCPs [3,4]. This warrants further understanding of the challenges inherent to patient positioning in bed, which is an area that has consistently been noted to be the most challenging during patient manual handling [16,24,25]. This scoping review sought to explore the nature of available evidence and to comprehensively map the challenging areas and best practices in manual handling practice for patient bed positioning in long-term care settings.

2. Method

This scoping review utilised a thematic analytical approach and a five-stage framework for conducting a scoping study recommended by (39].

2.1. Identifying relevant studies

This review was conducted using five health-related databases MEDLINE®, CINAHL, AMED, Embase, and Scopus. Additional papers were sought from grey literature *via* Google Scholar and websites, as well as hand-searching through reference lists of relevant studies. An initial pilot search was conducted with the first set of keywords ("Healthcare practitioners" AND "Patient Manual handling" AND "Patient positioning" AND "Work-related challenges") based on the PEO (Population; Exposure; Outcomes/themes) framework. These were redefined as appropriate for each database, as presented in Table 1. The author's University Librarian was also engaged for their advice on

Table 2. Inclusion/exclusion criteria.

Criteria	Inclusion criteria	Exclusion criteria
Population	Healthcare practitioners and patients in long-term care settings	Inanimate manual handling, short-term care, and acute therapy positioning, such as surgical positions, radiotherapy, anesthesia, and respiratory therapy.
Exposure	Patient manual handling positioning in bed (e.g. bed mobility, repositioning, lateral turning, side-lying, posture, and personal care).	Positioning in chairs, transfers, and mobility.
Outcome	Work-related musculoskeletal disorders, injuries affecting HCPs or patients, and psychosocial challenges.	No focus on injury outcomes to the healthcare practitioners. Only focus on pressure ulcer prevention without caregivers' outcomes.
Language	English	Not in English
Paper quality	Peer-reviewed papers (research articles, Perspective papers, clinical guidelines, expert recommendations, pre-prints, and registered trials)	Not peer-reviewed, textbooks, course material, blog posts, or news articles.
Access	Open-access papers, and those accessible through the university subscription or library assistance.	Not accessible.
Year of publication	From 1992 to 2024	Papers before 1992 were removed as the first safe handling policy was identified as the Manual Handling Operations Regulations (1992).

improving the sensitivity of the database searches. The initial search was carried out in March 2023 and was updated in October 2025.

2.2. Study selection criteria

The study selection criteria (Table 2) were based on the population, exposure, and outcome (PEO) framework for papers on patient manual handling positioning.

Papers that met the selection criteria were exported into citation management software (Endnote v.X8, USA) to remove duplicates and complete title/abstract screening. The screening followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) framework [35,40]. This included the screening of manuscript titles by the lead author, followed by reviews of abstracts of relevant titles to ensure fit with the subject of interest. Where the relevance of a paper in answering the research questions was uncertain, the full text of the paper was additionally screened, with some submitted for additional consideration and resolution by consensus of the research team.

2.3. Charting the data

A data charting framework was created using the NVivo software (version 12, USA). This stage involved coding and indexing the key themes identified. The key information index included the study characteristics, identified challenges, and optimized manual handling practices. The information extracted in this phase was included in the result thematic synthesis and the discussion of findings. A Quality appraisal was conducted using the Mixed Methods Appraisal Tool (MMAT) as it was suitable for the various study types included in this review [41]. Studies rated 4 or 5 points were considered high quality [41]. Each study was assessed according to its design category, and scores were summarized. Most studies demonstrated high methodological quality, particularly in experimental and non-randomized quantitative designs (Appendix 1).

2.4. Results synthesis

The codes generated were used to guide the thematic organization of the findings, which were presented following the TILEO framework [5]. A qualitative thematic synthesis was conducted on different research designs, including qualitative, quantitative, and non-empirical papers [42].

3. Results

3.1. Study selection

A PRISMA-ScR schematic representation of the papers' selection process is presented in Figure 1. Of 7,376 unique papers found across five databases, 118 met the criteria for inclusion and were included in the thematic synthesis.

3.2. Characteristics of available literature

Table 3 presents the characteristics of the papers that were reviewed. The majority of papers were conducted in the USA ($n = 56$) among the nursing population ($n = 75$) and were laboratory-based ($n = 34$) or pragmatic, longitudinal, pre- and post-intervention studies ($n = 19$). The laboratory studies primarily involved movement analysis, electromyography, force plates, and motion capture cameras to collect data on

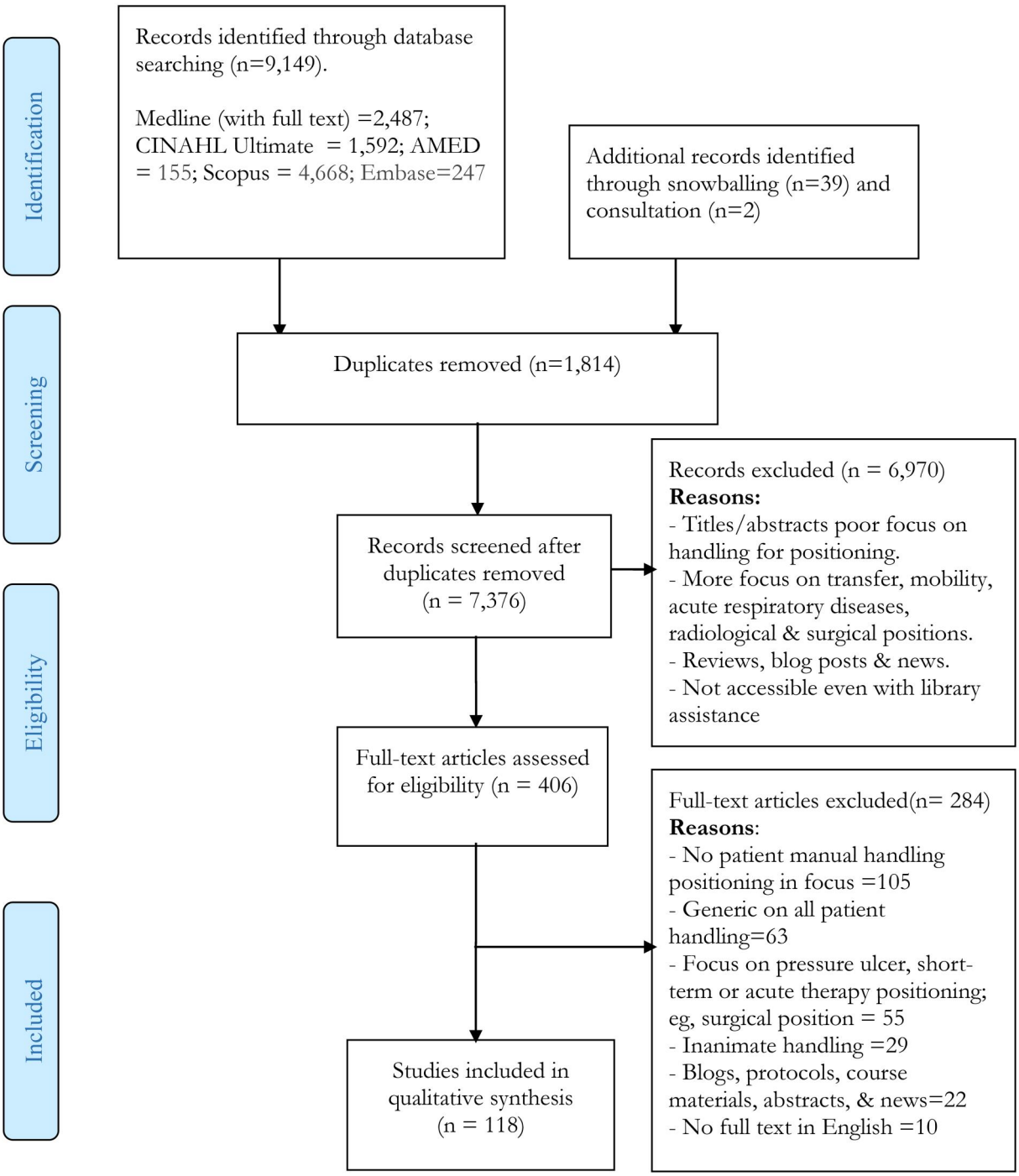

Figure 1. PRISMA-ScR flow diagram of scoping literature search and selection.

muscle activities, kinetics, and kinematics, respectively. Most of the pragmatic and longitudinal studies reviewed the records of injury claims in a pre- and post-safe patient handling program after mechanical lifts were installed, and repositioning aids, a zero-lifting policy, a handling care plan, and the use of handling algorithms were implemented.

3.3. Challenges and optimized approaches to promote patient and occupational health safety

Table 4 presents challenges impacting the effectiveness of available practices. The task-related factors were mostly during repositioning (66), followed by lateral turning ($n = 32$). The most HCP-related factors noted included staff shortages ($n = 20$), time limitations ($n = 17$), poor education and guidelines ($n = 15$), and poor staff compliance with training and policies ($n = 14$). The patient-related factors were mostly associated with high levels of disablement ($n = 40$), pressure ulcers ($n = 34$), bariatric ($n = 32$), and with resistant patients ($n = 19$). Also, the environment and device-related factors were mostly due to non-use of devices ($n = 22$) and working in a cramped space ($n = 17$).

Table 3. Quantitative mapping of the nature of available literature (multiple countries share the frequencies evenly).

Characteristics	Variable	Frequency	Variable	Frequency
Publications type	Cross-sectional surveys	14	Qualitative study	3
	Institutional Ethnography	3	RCT	5
	Laboratory study	34	Retrospective survey	3
	Systematic Review	1	Scoping Review	1
	Observational	6	Framework or Expert opinion	11
	Pragmatic intervention study	19	Narrative review	8
	Prospective survey	3	Perspective (commentaries)	15
Country focus	Australia	4	UK	11
	Canada	12	USA	56
	Germany/Italy	6	Japan	5
	Brazil/China/Denmark	6	Portugal/Taiwan	4
	Israel/South Korea	2	Sweden/Spain/Belgium	6
Year of publication	1992–2005	25	2013–2019	36
	2006–2012	31	2020–2025	25
Study population/Setting	Healthcare assistants	35	Community	10
	Nursing	75	Hospital	47
	Occupational Therapy	6	Laboratory	34
	Physiotherapy	13	Care homes	25

Table 4. Identified challenges in patient manual handling positioning.

Category	Challenges	Frequency	Challenges	Frequency
Task-related	Bed mobility	21	Prone positioning	3
	Personal care	27	Repositioning (boosting, lateral)	66
	Lateral turning	32	Side-lying	8
	Making occupied bed	6	Slide sheet insertion	4
	Posture management	10	Sling fitting	11
HCP-related factors	Agency & private industry	3	Perceived longer time with device	4
	Compliance	14	Physical fitness	6
	Female staff	16	Poor education & guidelines	15
	Higher BMI	4	Low bed height	6
	Higher job tenure	8	Previous injuries	5
	Perceived uncompassionate	4	Psychophysical activities	8
	Lack of safe handling policies	6	Staff shortage	20
	Long shifts	13	Staff turnovers	8
	Night shift	2	Time limitation	17
	Peer influence	11	Untrained caregivers	8
Patient-related factors	Bariatric	32	Incontinence	5
	Resistive	19	Muscle weakness &spasticity	9
	Hemodynamic instability	3	Tube dislodgement	5
	Comfort & dignity	8	Subjective & unique needs	3
	Contractures	6	Patients' preferences	9
	Female patient	3	Level of disablement	40
	Frailty	32	Infection/Pneumonia	3
	Impaired cognition	17	Pressure ulcers	34
Environment & device-related factors	Non-use of devices	22	Bed size & space	3
	Cramped workspace	17	Layout of workspace	5
	Enveloping soft surfaces	1	Poor bed height	4
	Furnishing & organization	5	Bed fixed to the wall	1
	Rehabilitation wards	7	Slippery/uneven floors	4

Table 5. Identified injury mechanisms and outcomes from patient manual handling positioning.

Category	Injury mechanism	Frequency	Injury mechanism	Frequency
Underlying hazardous force	Lifting(legs)	51	Friction & shear force	6
	Pushing or pulling	22	Shoulder moment	1
	Sliding	1	Spinal compression	20
	Sustained holding	12	Spinal tractions	1
	Hand coupling	15	Whole body vibration	1
Patient incident	Pain	12	Distorted sleep quality	3
	Falls	7	Entrapments	1
	Perceived uncompassionate	4	Bruising/skin damage	3
HCPs incident	Awkward postures	25	Strain	8
	Extended reaching	12	Torso flexion-bending	22
	Extensive walking	5	Twisting	13
	Overexertion	23	Unexpected movements	4
	Repeated handling	8	Unloaded standing	6
Injury outcomes	Back pain	54	Shoulder disorder	20
	Neck pain	11	Wrist and hand disorder	4
	Early retirement	4	Lost workdays	15
	Healthcare costs	20	Workplace frustration	2
	Injury claims	13	Job dissatisfaction	11

Table 6. Identified patient manual handling positioning equipment and devices.

Category	Handling devices	Frequency	Handling devices	Frequency
Friction-reducing devices /Low-tech devices	Draw sheets	15	Bedrails	3
	In-bed sliding system	5	Fluidized positioner	4
	Glide board	5	Mattress maximum inflation	4
	Low-friction rollers	5	Pillows	13
	Regular sheet	9	Rolled towels	1
	Slide sheet	39	Wedges	8
	Sliding board	11	Slide sheet handles	7
Integrated device system /Support surfaces	Pressure mapping system & Wearable sensors	6	Foam mattress	10
	Turning & repositioning system	10	Pressure-distributing mattresses	6
	Automated positioning system (turn-assist)	11	Skin microclimate control	4
Mechanicallifting devices	Air-assisted turning bed	11	Mobile hoists	31
	Ceiling-mounted hoist	37	Profiling beds	9
	Hoyer lift	3	Trendelenburg bed	2

Table 7. Identified manual handling patient positioning practice.

Category	Practices	Frequency	Practices	Frequency
Repositioning schedules/ Side-lying positioning	2-hourly	13	30° tilt	14
	3-hourly	1	45° tilt	1
	4-hourly	1	60° tilt	1
	Real-time repositioning	8	90° lateral position	5
Obsolete/Emerging practices	Bear hug'	1	Handling algorithms	9
	Cradle lift	1	Risk assessment	28
	Drag lifting	5	Safe handling programs	29
	Lift team	9	Single-handed care	8
	Partnered care	19	Turning effectiveness	3
	Log roll	1	Ergonomic features (sheet handle)	6
	Underhand grip	1	Zero-lifting' policy	19
Training/Guideline	Ongoing compulsory training	18	Health & Safety Executive (HSE)	7
	Competency screening	2	National Association of Orthopedic Nurses (NAON)	2
	University-level training	1	National Back Pain Association	3
	Training in body mechanics	18	National Institute for Occupational Safety & Health (NIOSH)	12
	Training in ergonomics & human factors	17	Occupational Safety and Health Administration (OSHA)	9
	Training on device usage	22	The American Nurses Association (ANA)	8
	Training on techniques	15	The Royal College of Nursing	6
	Train-the-trainers	3	U.S. Dept of Veterans Affairs	2
	Video training	2	The Manual Handling Operations Regulations (1992)	9
Head of bed elevation	0°-45°-0°	6	0°-30°-0°	8
	0°-60°-0°	3	Other head-of-bed elevation	12

3.3.1. Injury mechanisms from patient manual handling positioning

In Table 5, the persistent presence of some hazardous forces was noted during positioning, including lifting($n = 51$), pushing/pulling($n = 22$), and sustained holding($n = 12$). HCPs are at risk of WRMSDs caused by overexertion($n = 23$), torso-flexion ($n = 22$), and awkward postures ($n = 25$). The patients are also at risk of injuries from falls($n = 7$), distorted sleep($n = 3$), and skin bruises($n = 3$). These injuries are consequent to increased healthcare costs($n = 20$), lost workdays ($n = 15$), and injury claims($n = 13$).

3.3.2. Devices used to aid patient positioning on the bed

In Table 6, some devices were noted to have poor evidence, including Hoyal lift($n = 3$), and draw sheet($n = 15$), while a few, such as slide sheet (39), ceiling-mounted lift($n = 37$), turn-assist($n = 11$), Turning & repositioning system ($n = 10$), and in-bed sliding system($n = 5$) have been shown to significantly aid patient handling in bed.

3.3.3. Policy and practice guidelines

Table 7 noted a shift from obsolete practices centered around the manual lifting of patients, such as drag lifting($n = 5$) and the use of a lift team($n = 9$), to practices that emphasize minimal or zero lifting($n = 19$). The most cited guideline agencies leading the discourse of patient manual handling included the National Institute for Occupational Safety and Health (NIOSH)($n = 12$), Occupational Safety and Health Administration (OSHA)($n = 9$), The American Nurses Association (ANA)($n = 8$), and Health and Safety Executive (HSE)($n = 7$).

3.4. Thematic synthesis

The findings are presented under two overarching themes: First, injury-associated factors, which describe the multi-factorial presentations of manual handling risks based on the TILEO framework. The importance of recognizing these factors in a comprehensive risk assessment was highlighted as the first step towards reducing WRMSDs [43,44] as they inform appropriate control measures [18,44,45].

Second, optimized practices to promote patient and occupational safety, which describe existing evidence on current practices, including safe patient handling programs, use of handling devices and optimised techniques.

3.4.1. Healthcare practitioners' related factors

Survey studies on WRMSDs risk factors recorded more challenges when the caregivers working together have different heights [46,47a), staff turnovers [48], staff shortages, previous injuries, having up to 12-hour shifts, and low awareness of lifting policies [49]. Only a few papers, like an early cross-sectional study by (50], did not report a statistical association between injury risks and demographic factors of age, gender, height, weight, and BMI. Other related papers reported consistent findings where certain demographic features, such as being female staff [51], shorter work experience, and not engaging in job-simulated exercise, were correlated with higher injury risks [52,53].

WRMSDs are shown to be even higher among informal/caregivers and novice HCPs who often lack entry-level training in ergonomics and human factors [54–56]. Poor handling technique was noted among some HCPs, which caused more injury risk [57,58]. The experienced caregivers tend to engage the patient, involve them in the care task, utilized their movements, and apply only complementary force.

Also, differences in risk exposure were noted across care professionals. WRMSD prevalence ranging from 30 to 80% was noted among nursing staff, especially among healthcare assistants [59]. These HCPs were disproportionately exposed to overexertion from unsafe lifting, psychophysical activities, and the potential cumulative effect of repeated patient handling, which makes them second-ranked risk exposure after industrial jobs [60,61].

3.4.2. Service users or patient-related factors

Completely dependent patients usually need to be repositioned to minimize the negative effects of immobility. This is increasingly common among those in critical care (ICU) and geriatric settings [51,62]. These groups have a high risk of developing pressure ulcers, which is shown to be among the major causes of patient handling challenges [62–64]. More so, those in the ICU often have vascular or endotracheal tubing *in situ*, necessitating extra caution during their bed mobility to avoid dislodgement and injuries [49,65].

Bariatric patients are prone to frailty and health complications such as pressure injury [66,67] and often require more physically demanding interventions from the HCPs [21,29,68–70]. Those presenting with muscle weaknesses need more support for positioning and postural care, which are lacking in many long-term care settings.

Unlike inanimate material handling, the need to ensure patient safety and dignity means that caregivers need to make more effort and take caution. These challenges were noted to be higher among patients presenting with cognitive impairment and behavioural challenges such as uncooperative, confused, or resistive behaviours [63]. They make the HCPs at increased risk of twisting, holding, and unexpected movements, as well as increased risks of injury to the patient [7,8].

3.4.3. Manual handling care and risk-associated tasks

Commonly cited challenges of manual handling for patient positioning included repositioning (boosting, lateral repositioning), patient turning, personal care, side-lying positioning, posture management, and bed mobility [50]. This handling care frequently involves a high risk of awkward postures [71] due to the underlying need to push and pull patients from side-to-side, slide, or lift and move patients around the bed [32,62,72]. Repositioning and turning care were noted to be the most frequent and problematic bed positioning care and linked to high WRMSD prevalence [53,60,73–76].

There are identified underlying tasks during positioning, such as sling/slide sheet insertion, making an occupied bed, or changing pads [21,63,64]. Unavoidable lifting was the most cited underlying task, noted more in the absence of lifting equipment and training [77,78]. A large risk assessment study by (47a) reported that up to 73.8% of caregivers are still exposed to injurious lifting. This is despite the argument that the available risk assessment tools were not holistic in picking underlying risk factors [79].

3.4.4. Environmental factors

The nature of the care environment impacts patient manual handling, including the layout and ergonomic design of premises. Those that require excessive walking distances [44], cluttered spaces, slippery or uneven floors [80], and broken equipment [49] were cited. Across care settings, community/patient homes were commonly highlighted for cramped workspaces, beds fixed to the wall, carpeted floors, furniture with deep seats, malfunctioning equipment, restrictive patient clothing, and a lack of equipment [81,82]. This is also high in care homes due to the larger number of dependent patients compared to hospital settings [47a; 47b]. These factors contribute to persistent wrong practices.

3.4.5. Safe patient handling programs

3.4.5.1. Training limitations. The practice of compulsory and ongoing staff training was common [1,83–85]. However, while HCPs understand manual patient handling following their training, this may not always translate to anticipated behavioral change or decrease incidence of WRMSDs [86,87]. For instance, no significant change was noted in employee injuries after introducing a lift team that was trained in lifting techniques and body biomechanics [88]. Other factors, including poor adherence and relapses into old habits due to time constraints and challenging care environments, impact actual practices [87]. It is commonly accepted that training in proper body mechanics and manual techniques alone is not enough [44,64,86,88–90] as it does not account for tasks and loads that typically exceed recommended weights [86].

3.4.5.2. Safe handling policies. Training has been followed by additional lifting policies aimed at reducing injury risks. For instance, the Manual Handling Operations Regulations (1992) in the UK stipulated that care tasks should be need-based, and everyone is responsible for ensuring that both patient and HCPs are not exposed to unreasonable risk [59,83]. There is also the Health and Safety at Work Act (1974), which requires employers to ensure that safe work systems are in place and that all employees have the necessary skills, training, and devices for safe patient handling [83].

These policies have led to a campaign for 'zero lifting' during care, which has reportedly been in England since 1996 [89]. Zero lifting or minimal lifting policy insists that manual lifting is hazardous to HCPs, inefficient, and painful to patients [25,83,91–93]. The policy required HCPs to assess patient capacity, encourage the patient to move as much as possible, and as well as implement appropriate handling devices [83,92,94,]. It has enabled a change in belief that WRMSDs are inherent to healthcare work to the new belief that WRMSDs are preventable [95]. It was successful in abolishing old practices that were considered unsafe, including the 'drag lift', bear hug', and 'lift team', and was effective in reducing WRMDs [83,96].

Zero-handling policies did not completely remove HCPs' exposure to WRMSDs. HCPs were noted to still implement unsafe handling practices, showing low awareness of these policies, and some facilities lack a culture of safety or do not have functional handling policies [97,98] noted key challenges faced with the zero-lifting policy, including families perceiving the caregivers as being uncompassionate in instances where manual procedures were thought to have been needed urgently, as many device-assisted procedures often need time out for risk assessment. They advised an equal balance between risk and need as it is a requirement in the duty of care to promote and protect the interests and dignity of patients [83,84]. More critical analysis of these policies was provided in the institutional ethnography study of [95], who highlighted that subjective patient needs may often place HCPs in situations that intersect between the patient and the multiple hospitals' policies.

3.4.5.3. Safe handling programs. Zero-lifting policies are now incorporated into a program of safe practices with a culture of safety that holistically includes both the patient and the caregivers [99]. With the recognition that there is no safe way to lift or handle a patient manually [89,90,97], there were many reports on safe handling programs, usually as a more holistic intervention targeted at the various TILEO factors affecting patient handling. The primary components of these programs usually include the installation of mechanical lifts and repositioning aids, a zero-lifting policy, a handling care plan, and employee training on risk assessment, device usage, body mechanics, handling techniques, and guidelines [97,100]. Other components include a train-the-trainers approach, improved ergonomic designs, and device competency screening [101,102],.

These programs have enabled improved acceptance of handling equipment with consistent documentation of cost savings and helped reduce issues from HCP shortages [90,99,103]. Also, reduced workers' compensation claims, lost workdays, and healthcare costs were reported in many pre- and post-longitudinal pragmatic trials [104–107]. More recent pre-and post-studies showed a reduced risk of WRMSDs during log rolling and lateral transfer after HCPs were trained on optimized techniques, including core activation, using extended slide sheet handles, bent knees, a wide base of support, and an underhand grip [108,109].

While these programs are beneficial, organizational support and compliance remain insufficient to adequately reduce the risk of WRMSDs among HCPs [103,110] conducted a pre- and post-ergonomic intervention study among nursing assistants in eight facilities that received the installation of mechanical devices, training, and ergonomic principles for lifting. They reported improved ergonomic practices such as neutral spine postures and a marked reduction in the frequency of repositioning tasks with increased use of handling devices for transfer tasks, but notably, no significant improvement was shown in the use of devices for patient repositioning.

It is not clear if these programs are applicable in different settings, given the multi-factorial nature of patient handling. For instance, a recent study in Japan showed that more than 85% of HCP repositioned patients on the bed without handling devices, even when they are provided [98,110] reported that program benefits were lower in centers with high turnover and agency staffing, whereas less time pressure, better teamwork, HCPs' communication, and supervisory support showed better injury reduction in their multi-site study.

3.4.6. Use of manual handling equipment

Manual patient handling without adequate devices is noted as the most important risk factor for WRMSDs. The National Association of Orthopedic Nurses recommended that handling equipment should be used for completely immobile patients weighing 35 kg and above [111]. Despite the increased recommendation and availability of handling devices, these remain underutilized. This is usually due to device problems, space and furnishing, work organization, cost, and poor education and training [47b). Some identified devices used for patient positioning included friction-reducing devices, such as slide sheets, and low-tech devices such as pillows and wedges, as well as turn assist, pressure-relieving mattresses, and mechanical devices such as hoists and profiling beds [44].

3.4.6.1. Slide sheets and sliding systems. Slide sheets and sliding systems are designed to help caregivers in conducting lateral repositioning, boosting, and turning. When compared to traditional cotton sheets or no sheets, slide sheets were shown to significantly reduce lumbar compression, lumbar sagittal shear forces [112,113], shoulder hand forces [26,56], and significantly reduce subjective fatigue with better job satisfaction [13,24,28]. While repositioning with a sliding sheet can be done by two or one caregiver, the standard of care in many policies recommends usage in pairs to help distribute physical effort and reduce injury [27,46] demonstrated that the two caregivers' approach significantly reduced the risk of WRMSDs but still had relatively high spinal loads. They reported that repositioning was 'the worst patient handling job' and recommended combining devices and techniques such as the positioning system.

The sliding sheet was also considered challenging, especially when inserting it underneath immobile patients. This affects the optimum use of sliding sheets in care because of the perceived additional time required compared with non-assisted handling [13,114]. Thus, there is no certainty regarding slide sheet effectiveness in reducing WRMSDs [24]. Sliding patients during repositioning was noted, to contribute to WRMDs, as most sheets tested exceeded the recommended force threshold [24–30].

> The limitation in standard slide sheet led to the introduction of an in-bed sliding system [31,115], which remains under the patient, and does the additional work of repositioning [63]. Studies comparing lateral patient-handling tasks when using no sheet, standard slide sheet, and the in-bed sliding system showed that the system significantly reduced back muscle activity, hand force, and perceived exertion [31,116].

3.4.6.2. Mechanical devices for positioning. The air-assisted turning devices were shown to significantly reduce spine, hand and shoulder force, and were preferred over slide sheets during patient turning [29,46,117]. However, recommended thresholds for spinal load and hand force injury risk were still exceeded in many turning and repositioning tasks [30].

Other mechanical devices reported included overhead lift systems and mobile hoists. They are often needed for large movements against gravity. Its impact on manual handling challenges was well linked to some handling components like transfer and mobility, but less on those around positioning [15,17,18]. Mechanical lifts were effective in reducing peak loading, but may not reduce cumulative loading [19,45].

3.4.6.3. Automated mechanical devices. Knibbe et al. [69] reported an automated (electronic turn-assist) repositioning system, which reduces handling time, and HCPs perceived fewer WRMSD symptoms, but did not prevent pressure ulcers. They were also indicated to have the potential to replace manual repositioning, improve the handling of bariatric patients, and act as second handlers [16,118,119]. It remains unclear whether automated beds are available across care settings, and possible concerns regarding costs and vestibular impact on the patient.

3.4.6.4. Positioning systems. Improved outcomes were reported when a system integrating mechanical and low-tech devices was used [13,19,120–122]. For instance [25] reported the lowest lumber loading when smaller aids were combined with a mechanically optimized approach. Although their findings exceeded the acceptable ranges for safe lumbar-sacral loading across different ages of the HCPs, they began to show a potential reduction in WRMSD injury rate when combining low-tech devices with mechanical devices. Also [121] conducted a comparative analysis between an overhead lift used in conjunction with pillows and a patient

positioning system including an air-powered mattress with wedges. Their findings indicated that the positioning system enabled a greater turn angle and improved the patient's ability to sustain the turn for one hour. They recommended further research to optimize turning and repositioning strategies for ease of use.

The in-bed sliding system is commonly used as a component of a positioning system with ergonomic features including a low-friction glide sheet with grip surfaces and handles to reduce the effort needed to turn patients, a built-in anti-shear strap to prevent patients from sliding in bed, disposable microclimate body pads to control heat and assist with moisture control, and two 30° body wedges to improve turning effectiveness [14,116,123]. Such a system has been shown to improve nurses' compliance with repositioning schedules, reduce pressure injury incidence, and improve patients' positioning practices, such as the accuracy of the 30–45° tilted side-lying position [123]. It was noted that lifting hoists with a spreader bar can be fastened to the handle of a sliding system and were beneficial in facilitating effortless and single-handed turning [116,124]. This indicates that the high occupational risk activity of turning and positioning a patient can be reduced by integrating these devices as a positioning system. It remains inconclusive in the literature regarding how the in-bed sliding system affects objective measures of HCPs' injury exposure, patients' comfort, and factors affecting their availability across settings. For patients who are hyperactive and at risk of sliding down the bed, an in-bed sliding system could increase shear force and pressure damage [116].

3.4.7. Positioning and repositioning practices

3.4.7.1. The 30° tilt turn angle. Positions such as the supine, semi-recumbent, side-lying, and prone were common and usually alternated based on patients' therapeutic needs [32,33]. Studies on side-lying practice bordered on appropriate turn angle and offloading or redistributing pressure away from bony prominences [8,99]. The 30° tilt method, when effectively implemented, was commonly considered an adequate turn angle to reduce contact pressure in the patient-surface interface [22,30,66,119,123]. Available evidence has noted a practice gap with the 30° tilt, as patients often return to a supine position due to poor cushioning [100,125] reported a sub-optimal turn-angle among ICU nurses, even with the use of real-time feedback obtained from the wearable sensors. Using wedges improved turning effectiveness, required fewer HCPs, and reduced pressure injury incidence than using pillows [116].

On the contrary [126] conducted an RCT study to evaluate the effect of 30° tilt methods, 90° lateral position, and supine positions in reducing the incidence of pressure injury. The findings did not support the use of the 30° tilt method among frail patients compared to the other positions. Also, 78% of participants reported that they experienced difficulty in adopting and maintaining the position. The 30° tilt could be difficult for people who are obese [99]. This could indicate a need for clear guidance on optimal individualized positioning practices.

3.4.7.2. Semi-recumbent positioning. Semi-recumbent positioning involves head-of-bed elevation up to 15 to 90 degrees. This was noted to be useful for preventing gastroesophageal reflux and improving ventilation in patients with respiratory conditions [127]. However, raising the head of the bed principally turns the patient's support surface into a ramp, with the tendency for the patient to slide down, increasing repositioning frequency [128–131]. This migration of patients in bed is usually associated with internal shear strain in the adipose near the sacrum and coccyx [132]. Different degrees of inclination create different pressure levels around the bony prominences, which increase with the angles of elevation [35,66], in females, higher BMI [66], the positioning style, and the tilt angle adopted [133]. It is also influenced by bed type and mattress pressure but can be reduced by knee elevation using the profiling function of the beds [130].

A contrary finding was reported in the RCTs of [134], who assessed sacral and heel subepidermal moisture among 20 healthy subjects when the head-of-bed was elevated to 30° and 60° for 30 min. Their result showed no significant difference in the two outcome measures across age, sex, BMI, and skin type. This difference was thought to be due to the interface pressure assessment device used. There are also challenges with trial time and confounding factors from healthy adults' homeostasis; as many of the papers used one hour, but [135] pointed out that 50% of any time spent in a given position is needed for tissue reperfusion to be completed. These findings on interface pressure emphasize the need for patient-centered positioning practice.

4. Discussion

This scoping literature review explored the challenges and current practices that promote patient and occupational health safety during patient manual handling positioning in bed in long-term care settings. The findings have highlighted different manual handling challenges, including their underlying tasks and available optimized practices, as well

as the obsolete practices that are now deemed unsafe. These papers provide strong support for the usefulness of a multi-factorial approach to reducing manual handling challenges.

The nature of available evidence is consistent with previous reviews that have reported that most studies were conducted in the USA among the nursing population and in laboratory settings [36,136,137]. This review is the first to focus on the positioning aspect of patient manual handling, informed by previous reports of persisting challenges in this area [18,20,24,36]. While positioning care is subject to generic manual handling-related challenges, there are peculiar limitations noted in the available practices for positioning. When compared to the transfer and mobility components of manual handling, rates of injuries that occurred during positioning were less likely to be reduced with interventions involving mechanical lifts [15,17,18]. Positioning care seems to require more precise and extensive use of physical efforts, thus defying the usefulness of available devices [19,110].

However, many safe handling programs were based on installing mechanical lifts. While the usefulness of these handling programs was commonly reported [97,104,138], they relied on administrative data of injuries reported and claims made, which have possible selection bias from under-reporting [139]. It remains unclear regarding their biomechanical impact on HCPs' exposure to WRMSDs [136] and factors such as HCP turnover rate, sustainability, and hospital size [85,110b; 140].

Repositioning and turning patients into side-lying appeared to be the most challenging bed care task commonly associated with high rates of WRMSDs [29,38,74,75,110]. Lots of success has been recorded from the initial step to reducing manual lifting, with some countries adopting safe patient handling policies that are aimed at zero lifting. However, except for an expensive and mostly unavailable automated positioning system, available innovations and techniques for aiding these maneuvers on the bed are noted to have their limitation and do not completely remove the risk of excessive exertion from the HCP [29,110]. Common positioning devices, such as the slide sheet, have been noted to still contribute to WRMSDs, as most sheets tested empirically exceeded the recommended force threshold of 16 kg even during partnered care [25–27,29,112]. Turn-assist and air-assisted turning devices showed beneficial results [29,30,46,117], but their use across settings appeared limited, which could be due to their limitations in terms of cost, work time, and longer care algorithm.

These limitations could mean there are few evidence-based solutions available for repositioning and turning, and available empirical research [14,31,56] has adopted different approaches to turning patients in bed. For instance, in [56] evaluation of slide use for patient turning, it was not clear if the forces exerted were within the safe threshold and if any of the patients' limbs were initially flexed before the turning task. Improving the ergonomics of the algorithm for implementing positioning tasks could offer a more adaptable approach to reducing manual handling challenges.

These gaps in positioning could explain the persisting challenges, given the many underlying manual forces needed to implement patient positioning, including lifting, pushing/pulling, sustained holding, and sliding [46,103,141]. Notable gaps exist in practice guidelines to effectively turn and reposition a completely dependent patient [38]. Most research with promising findings has not been translated to practice across settings due to the multi-factorial (TILEO) nature of patient manual handling. Key recommendations for further research consistently highlight that implementing a system of safe handling devices, which include friction-reducing tools, low-tech cushions, and optimized support surfaces, combined with an ergonomically safe working algorithm for patient positioning in bed, are core to improving outcomes [25,29,116,123,141]. There is a research gap for objective biomechanical measures of how the combined use of these devices impacts HCP injury exposure and patients' safety, as available studies have often collected self-reported injury claims or reported unclear working algorithms.

4.1. Strengths and limitations

Limitation of this review may include the effort to narrow it down to positioning aspect of patient handling, neglecting the intersecting covariates of other component of patient handling, including transfer, support surfaces, and pressure ulcer prevention. The major strength is its comprehensive and in-depth thematic synthesis of available evidence up to 2025. Also, this is one of the few physiotherapy-led studies on this topic in line with the gap and recommendation [136] made for more allied professionals-led research, as they lead manual handling practices in the UK care settings. Physiotherapists play an important role in clinical decisions and MDT leadership for patients' manual handling. This is due to their experience in assessing patients' level of independence and determining the level of assistance needed by individual patients, which allows the achievement of their rehabilitation to be fully independent or to a function feasible and achievable.

5. Conclusion

This scoping review has identified persisting challenges in conducting patient manual handling, especially during repositioning and turning into sidelying. Positioning tasks (e.g. posture care) often require precision and caution that may defeat the usefulness of high-tech lifting devices. Implementation of commonly available devices, such as slide sheets, hoists, and pillows, has fallen short in significantly reducing the incidence of WRMSDs during patient positioning in bed. These were mostly reported to fall short in reducing excessive exertion from the HCPs. Recent evidence supported the use of integrated systems of low-tech handling devices, such as breathable pillows, wedges, air-assisted turning devices, and in-bed sliding systems. Also, using optimized techniques, such as using slide sheets to turn the patient. However, further work is needed to quantify the biomechanical impact of these systems on the HCPs and patients during repositioning and turning.

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Author contributions

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