Health Innovation East

NHS Wound Care: A rapid evidence scoping review to identify interventions and approaches to improve outcomes for people with, and at-risk of, pressure ulcers.

EVIDENCE REVIEW COMMISSIONED BY THE PRESSURE ULCER WORKING GROUP

COMPLETED ON BEHALF OF HEALTH INNOVATION EAST

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Contents

Background and Context

Rationale

The Pressure Ulcer (PU) working group is an extension of The National Wound Care Strategy Programme (NWCSP) and is commissioned by NHS England. The PU working group commissioned Health Innovation East to conduct a rapid literature review to synthesise the evidence on relating to improvement and evidence-based approaches to managing pressure ulcers. The findings and insights gained are intended to help inform the future plans of the pressure ulcer wound care improvement programme.

Review Aim

To scope the evidence for quality improvement studies and intervention studies which have the aim to improve outcomes for people with existing, or at-risk of developing, pressure ulcers.

The review specifically sought to scope the evidence for studies which reported quality improvement and interventional studies which improved patient outcomes, reduced the harm caused by pressure ulcers, reduced the occurrence of pressure ulcers and/or reduced the severity of pressure ulcers.

Methods

We conducted this review using scoping review methodology (1). The review is reported in line with the Preferred reporting items for systematic reviews and meta-analyses extension for Scoping reviews (PRISMA-ScR) checklist (2).

We developed a protocol in line with the specification provided by the National Wound Care UK team. The specification set out the scope for the review using the PICO (Population, Intervention, Context, Outcomes) framework. The agreed protocol set out the following methodology:

Eligibility Criteria

Table 1 provides a summary of the eligibility criteria agreed. Studies were eligible for inclusion if they described implementing or reviewing implementation of a quality improvement or multi-component intervention design, which aimed to improve

outcomes for people with existing, or at-risk of developing, pressure ulcers in a health or care setting.

Table 1. Inclusion criteria

Population:	People with existing pressure ulcers or pressure injuries
	People at risk of pressure ulcers or pressures injuries
	People of any age
Intervention:	Evidence-based best practice
	Quality improvement approach
	Change management approach
	Intervention
Context:	Health and care settings
Outcome:	Reduced harm of pressure ulcers
	Reduced severity of pressure ulcers
	Reduced occurrence of pressure ulcers
	Improved outcomes for patients

Non-English language studies, non-human studies and studies published before 1st January 2014 were excluded. We also excluded study protocols and conference abstracts, where no published data were available. We excluded studies which aimed only to report the prevalence or incidence of pressure ulcers, and where the application or implementation of products were assessed. We only included systematic reviews for citation searching of the reference list and excluded any other type of review.

Due to the considerable extent of the literature, we met with Jacqui Fisher from the PU working group on 11th April 2024 to refine and focus the scope of the review. After discussions, we agreed to proceed with excluding case reports, studies relating to Covid-19 mask use, studies which evaluated or investigated the impact of a specific product or single factor.

Search Strategy

We conducted searches in MEDLINE (PubMed), CINAHL Ultimate (EBSCO) and Cochrane Library. We searched online databases from 01/01/2014 to 26/03/24. The search was adapted for use in each of the online databases. The search strategy used in Cochrane is reported in Appendix 1.

We also reviewed the reference lists of relevant systematic reviews, for any potentially eligible included studies. Grey literature was searched for via the British Medical Association (BMA), General Medical Council (GMC), Nursing and Midwifery Council (NMC) and British Association of Dermatologists (BAD) websites for published reports which met the eligibility criteria.

We did not search the National Institute for Clinical Excellence (NICE) or European Pressure Ulcer Advisory Panel (EPUAP) websites, as agreed with the PU working group who were already aware of the clinical guidelines pertaining to pressure ulcer prevention and management.

We developed the searches based on the following framework: [person with/at-risk of pressure ulcers] AND [Intervention/ approach] AND [improved outcomes for pressure ulcers]. We consulted the PRESS checklist (3) guidance in developing the search strategy, to ensure that the strategy was robust and comprehensive.

Selection of sources and evidence

We exported citations from each online database into EndNote reference management software, and then exported the XML files of the records into Covidence systematic reviewing software. We used Covidence for all stages of the review process.

All records were screened for inclusion using the eligibility criteria by a team of reviewers. The lead reviewer independently duplicated the screening of 20% to ensure consistency. We firstly screened titles and abstracts of all records. We then screened the titles and abstracts of all remaining records with the revised eligibility criteria. We tagged all studies which required a full text PDF uploading for review, and sourced and uploaded PDFs for these eligible records. We then conducted full text screening, assessing each of these records for inclusion within the review. The lead reviewer independently duplicated the screening of 20% of these records to ensure consistency.

Data charting/Extraction

We conducted data extraction in Covidence. The lead reviewer developed the data extraction template in Covidence, enabling the team to extract details relating to the PICO framework: document details, participant information, study design, setting, details of the quality improvement/multicomponent intervention, and data items relating to the review outcomes (pressure injury severity, pressure injury occurrence, harm relating to pressure ulcers and patient outcomes). A reviewer extracted details from each included study independently, and the lead reviewer checked each data extraction for accuracy and completeness.

Synthesis of results

We tabulated data items in a brief 'characteristics of included studies' Table 3(Table 3), which can be found at the end of this document. We have also provided the full data extraction table in (Supplementary File 1) We also provide the excluded studies within (Supplementary File 2). We conducted a narrative synthesis of the review findings relating to the key outcomes.

Results

Selection of sources of evidence

From 5244 records, of which 2601 were de-duplicated in Covidence, we completed title and abstract screening for 3601 records. We excluded 2485 studies at this stage and assessed 1088 records at full text screening stage with the revised eligibility criteria. We were unable to source 28 full texts at this stage. From these 1088 records, we included 45 studies which met our eligibility criteria. Figure 1 provides a PRISMA diagram that summarises the records at each stage.

Additional records that we identified from reference lists of included systematic reviews were not retried, either because these studies were already included, we were unable to source the full text, or the studies did not meet our eligibility criteria for this review. We did not retrieve any eligible grey literature from relevant organisations' websites.

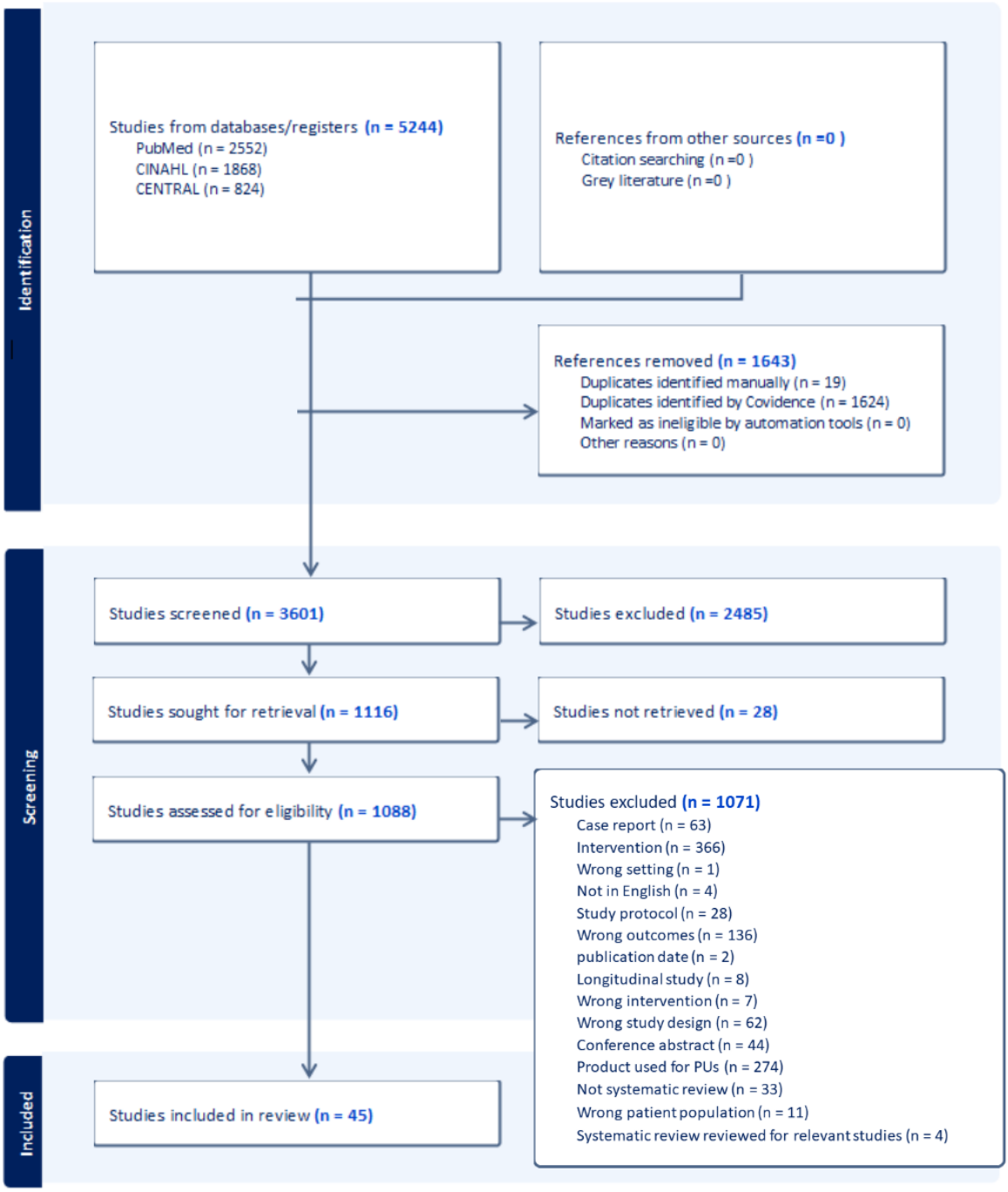

Figure 1. PRISMA flowchart

Synthesis of results

We present a narrative synthesis of review findings, categorised by review outcomes. The most common outcome reported within the included studies was that the intervention or quality improvement approach reduced the occurrence of pressure ulcers for their population or participant sample. It is important to note that not all included studies aimed to meet all outcomes explored in this review. Studies included in this review, more commonly aimed to reduce the occurrence of pressure ulcers, than other outcomes.

Characteristics of sources of evidence

We included 45 eligible studies within this scoping review. A summary table of included studies can be found in Table 3. Twenty-six of the studies followed a quality improvement design, fifteen followed an interventional design and four followed an observational design.

Studies are reported from 15 countries: USA (12), UK (8), Australia (5), China (5), Saudi Arabia (2) Argentina (2), Denmark (2), Italy (1), Abu Dhabi (1), Canada (1), Qatar (1), Iran (1), Lebanon (1), Turkey (2), Taiwan (1).

Included studies predominantly report findings from hospital settings, however some studies do report findings from outpatient settings and long-term care settings. Included studies report findings from all age groups, from neonates to older adults.

Interventions/improvement approaches which improved patient outcomes

Thirteen studies reported that their improvement approach or intervention improved outcomes for patients (12, 17, 21, 22, 25, 29, 33, 35, 37, 38, 43, 44, 48). The types of improved patient outcomes varied across studies and depended upon setting or population. For example, one study reported that paediatric patients spent fewer days in ICU, compared to the cohort of children admitted to hospital the year previously, before the quality improvement method had been implemented in the hospital (12). In some studies, improved patient outcomes related to prevention of skin irritation developing into pressure ulcers (33), or lower self-assessed anxiety and depression scores in older adult patients who received the multi-component nursing intervention, which aimed to reduce pressure ulcers in this population (17). Other studies reported a reduction in pressure ulcers caused by medical devices or immobility (37) and improvements in wounds and improved healing of existing wounds for diabetic foot ulcer patients (48). Table 2 provides a summary of the interventions and improvement approaches within the included studies.

Interventions/improvement approaches which reduced harm caused by pressure ulcers

Ony three studies (13, 22, 25) specifically reported outcomes whereby patients experienced reduced harm, due to the intervention or improvement approach. One of the studies reported that adult ICU patients who received the InSPiRE BUNDLE were significantly less likely to develop heel pressure injuries, and generally less likely to develop skin injuries, compared to patients in the control group ($p=0.023$)(13), reducing the potential harm caused to patients. Gu *et al.* (2022) reported that patients' wound healing rate was significantly higher in the intervention group (96.77%) than the control group (80.65%, $p<0.05$) in a Chinese hospital (22). Hu *et al*. (2022) also reported an improved wound cure rate in their population of older people accessing secondary care, primary care and community health services (90.11% vs 26.43%)(25).

Interventions/improvement approaches which reduced severity of pressure ulcers

Seventeen studies reported that their intervention or improvement approach reduced the severity of pressure ulcers (4, 5, 7, 11, 13, 17, 18, 21, 22, 24, 29, 35, 37-41). Many of the included studies reported consistently fewer and less severe grades of pressure ulcers post-intervention. Some studies reported that pressure ulcers per person, had reduced post-intervention (7, 13). However, some studies only reported a reduction in severity of pressure ulcers for some grades of pressure ulcers. For example, Frank *et al*. (2017) only reported a reduction in grade 3 and 4 pressure ulcers in paediatric patients across 22 paediatric hospitals (18), and Gupta *et al.* (2020) reported a reduction in grade 2 pressure ulcers after implementing the SSKIN bundle on their hospital wards (21).

Interventions/improvement approaches which reduced occurrence of pressure ulcers

Thirty-nine studies reported that the intervention or improvement approach resulted in a reduction in pressure ulcers occurring (4-10, 13-21, 23-39, 42-47). Whilst the majority of the included studies did report reduced occurrence of pressure ulcers post-intervention overall, not all of these reductions were statistically significant reductions, meaning that the results could have been caused by chance. Not all studies reported the same reduction in occurrence of pressure ulcers, for all grades of pressure ulcers within their population. Some grades of pressure ulcer had better outcomes from the intervention, than others. Some studies reported that whilst there was a reduction in

the occurrence of pressure ulcers post-intervention for some stages of pressure ulcers, an increased prevalence of pressure ulcers was reported for some other pressure ulcer stages. Where this is the case, we have specified in Table 3 for which pressure ulcer stages the outcomes related to. For example, Damery *et al.* (2021) reported that post-SPACE programme intervention in 29 UK care homes, the occurrence of Grade 2 pressure ulcers increased (1.0 vs 1.2/100 beds/month)(16). The same study reported no change in Grade 3 pressure ulcers occurrence, but a reduction in Grade 4 pressure ulcers (0.3 vs 0.2/100 beds/moth) (16). In some studies where the intervention was implemented across different populations, the outcome of the intervention sometimes differed between groups. For example, in Goodman et al.'s (2018) hospital wide improvement plan, which aimed to improve hospital acquired pressure injuries, the prevalence of pressure ulcers only reduced in the non-ICU patient group, whilst the prevalence of pressure ulcers increased in the ICU patent group post-implementation of the improvement plan (20).

Table 2: Summary of included studies

StudyID *(Author, year) (reference)*	**Intervention and setting**
Alshahrani 2024 (4)	Educational intervention to prevent pressure ulcers in critical care
Anderson 2015 (5)	SAFER prevention bundle in ICU
Aningalan 2023 (6)	Extensive quality improvement project in hospital
Aprea 2018 (7)	Healthcare quality improvement intervention in PICU
Barakat-Johnson 2020 (8)	PARiHS framework to reduce pressure ulcers in Health Centres
Birkill 2020 (9)	Nurse-led clinical quality improvement intervention in hospital
Cano 2015 (10)	Multidisciplinary improvement program to prevent pressure ulcers in Hospital
Chen 2021 (11)	Bundled nursing management in care of older people
Ciprandi 2022 (12)	Hospital-wide quality MDT improvement approach to prevent paediatric intraoperative pressure ulcers
Coyer 2015 (13)	InSPiRE protocol to prevent pressure ulcers in ICU
CullenGill 2015 (14)	Action plan to prevent pressure ulcers in ICU
Cummins 2019 (15)	Implementation of evidence-based pressure ulcer prevention strategies in PICU
Damery 2021 (16)	The SPACE programme implemented across 29 care homes

Deng 2024 (17)	Predictive nursing interventions for older hospital patients
Frank 2017 (18)	5-element PI prevention bundle into children's hospitals
Fremmelevholm 2019 (19)	Nurse-led clinical quality improvement intervention in hospital
Goodman 2018 (20)	Multifaceted quality improvement initiative in hospital
Gupta 2020 (21)	Quality improvement project including SSKIN bundle in hospital
Gu 2022 (22)	Multidisciplinary collaborative care approach in treating pressure ulcers in cerebral infarction patients
Heywood 2015 (23)	Pressure ulcer prevention programme including SSKIN bundle in hospital.
Holbrook 2021 (24)	Pressure care intervention to prevent pressure ulcers in hospital
Hu 2022 (25)	Three-Level Linkage system to prevent and treat pressure sores in older patients
Jafary 2018 (26)	Multifaceted care program intervention in hospital
Kriesberg 2018 (27)	Evidence-based protocol to prevent pressure ulcers in a paediatric cardiac care unit
Lavallée 2019 (28)	Evidence-informed care bundle to prevent pressure ulcers in nursing homes
Loudet 2017 (29)	Multifaceted intervention including a family prevention bundle for ICU patients
Luton 2018 (30)	Evidence-based skin champion program in a paediatric hospital
Mackie 2014 (31)	Multi-faceted quality improvement initiative in hospital
Mallah 2015 (32)	Multi-model program in hospital
Mietzsch 2019 (33)	Quality improvement project to prevent pressure ulcers in NICU
Moyer 2022 (34)	Interdisciplinary quality improvement project in NICU
Richardson 2017 (35)	4-year quality improvement project using an evidence-based care bundle in CCUs
Romito 2023 (36)	Multidisciplinary quality improvement perioperative pressure injury prevention approach in a Military Medical Treatment Facility
Simsic 2019 (37)	Pressure ulcer prevention project in PICU
Singh 2023 (38)	Pressure injury prevention bundle in hospital
Tayyib 2017 (39)	Pressure ulcer prevention care bundle in hospital
Tinker 2020 (40)	Multifaceted communication strategy: Save our Skin (SOS) in hospital
Waird 2021 (41)	Quality improvement project in a residential older person care facility

Woodhouse 2014 (42)	Education and training programme delivered by industry to community staff
Wood 2019 (43)	2-year Pressure Ulcer Collaborative using IHI Breakthrough Series model project, across secondary care, primary care, community and ambulance services
Wu 2023 (44)	Transnasal tube-related pressure injury prevention program in hospital
Yilmazer 2019 (45)	Pressure injury prevention protocol in a nursing home
Yilmazer 2022 (46)	Pressure injury prevention care bundle in ICUs
Young 2015 (47)	Medline Pressure Ulcer Prevention Program in a long-term acute hospital
Yu-Tsung 2015 (48)	3-step wound management service in a Wound Care Center

Strengths and limitations

The findings of this scoping review provide an evidence-base for quality improvement and multicomponent interventions improving outcomes for pressure ulcers, and patients experiencing pressure ulcers. The included studies within this review report many different types of intervention or improvement approach, with varying complex components, implemented into different settings and involving different groups of people. Whilst some interventions had positive impacts on some grades of pressure ulcer, the same intervention did not always consistently have the same impact on the grades of pressure ulcer within the same population. In a minority of cases, pressure ulcers were more prevalent post-intervention. It is important to note that the majority of studies included within this review were observational study designs, and so cause and effect cannot be inferred. Only in a randomised controlled trial could cause and effect be established from implementation of an intervention. It is therefore important to reflect on the potential generalisability of findings from each included study to other settings, or different populations.

We conducted the review applying scoping review methodology (1), which included systematic methods and quality control throughout the review process. However, there is a chance that we have not included all potentially eligible studies, due to being unable to source some full texts for studies, the scope of the search strategy and/or human error. We did not conduct critical appraisal of included studies and therefore cannot provide information about the risk of bias or robustness of each included study. Whilst all of the included studies reported improvements for at least one of the pressure ulcer outcomes, not all of the outcomes were statistically

significant, and so this should be a consideration when future planning a pressure ulcer prevention or management programme.

Conclusions

We included 45 eligible studies providing evidence of quality improvement and interventional studies which aimed to improve outcomes for people with existing, and at risk of pressure ulcers. Studied were from 15 different countries, and included participants across the lifespan, reporting outcomes from neonates to older adults. The interventions and programmes implemented within the included studies mostly included a combination of staff education and training, equipment, skin care, leadership and updated policy and guidance.

Table 3: Brief characteristics of included studies table

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
Alshahrani 2024 (4)	Observational pre-post intervention study	3 critical care units (Kingdom of Saudi Arabia)	CCU patients	Staff training/education Skin inspection/assessment Educational intervention	Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers
Anderson 2015 (5)	Quasi-experimental pre and post intervention design	Hospital (USA)	ICU patients	SAFER prevention bundle: Skin care, Skin inspection/assessment, pressure distribution surfaces, PU identification, repositioning WOC nurse ward rounds Nurses trained as skin champions	Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers
Aningalan 2023 (6)	Quality improvement project	Community hospital (USA)	CCU and adult medical-surgical patients	HAPI surveillance and monitoring Staff education/training MDT approach Skin care champion Staff empowerment and engagement	Reduced occurrence of pressure ulcers
Aprea 2018 (7)	Uncontrolled before and after study.	Paediatric intensive care unit (Argentina)	Paediatric patients >1month	Implementation of Healthcare Improvement program: Staff training Skin care Pressure relief Assessment of risk for PUs	Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers
Barakat-Johnson 2020 (8)	Implementing evidence-based practice	Local Health District (Australia)	People accessing tertiary and community health centres	PARiHS framework: Staff education/training Monthly auditing	Reduced occurrence of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
				PI taskforce established Nurse wound champions	
Birkill 2020 (9)	Quality improvement intervention	University Hospital (Denmark)	Inpatients of any department >15 years	PU specialist nurse Steering committee established PU prevention guidelines PU prevention theme days Monitoring of PU prevalence	Reduced occurrence of pressure ulcers
Cano 2015 (10)	Quality improvement project	Acute Care Academic Medical Center (United States)	Inpatients	Pressure surfaces replaced Monitoring of PU prevalence Protocols for PU prevention Wound care nurses manage PUs Repositioning Staff education	Reduced occurrence of pressure ulcers
Chen 2021 (11)	Prospective study	Hospital (China)	Inpatients >60 years	Staff education MDT approach to PU management Psychological Counselling Nutritional support	Reduced severity of pressure ulcers Improved outcomes for patients
Ciprandi 2022 (12)	Quality improvement project	Paediatric hospital (Italy)	Paediatric inpatients	Establish an MDT Education Double prevention strategy	Reduced occurrence of pressure ulcers Improved outcomes for patients

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
Coyer 2015 (13)	Before and after interventional design	36-bed adult ICU (Australia)	General medical, surgical and trauma ICU patients	InSPiRE bundle: Skin assessment Skin hygiene Repositioning Pressure support surfaces Patient mobilisation Nutritional assessment Staff training/education PU prevention PU auditing	Reduced harm of pressure ulcers Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers
CullenGill 2015 (14)	Quality improvement project	Hospital ICU (Abu Dhabi)	ICU patients	Staff training/education MDT referrals PU prevention policies updated	Reduced occurrence of pressure ulcers
Cummins 2019 (15)	Quality improvement project	Paediatric ICU (USA)	Paediatric ICU patients	Staff education/training Repositioning Nutritional assessment	Reduced occurrence of pressure ulcers
Damery 2021 (16)	Quality improvement project	29 Long-term care settings (UK)	Long-term care residents	SPACE programme: Staff training/education	Reduced occurrence of stage 4 pressure ulcers only
Deng 2024 (17)	Multi-component intervention	Hospital (China)	Older patients confined to bed	PU risk assessment Staff training/education	Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
				PU management Psychological intervention	Improved outcomes for patients
Frank 2017 (18)	Multicomponent Intervention	33 Paediatric hospitals (USA)	Children	PU surveillance Wound ostomy team Implementation of PU prevention bundle	Reduced occurrence of stage 3 & 4 pressure ulcers only Reduced severity of pressure ulcers
Fremmelevholm 2019 (19)	Quality improvement project	University Hospital (Denmark)	Inpatients >15 years	PU prevention Staff education/training	Reduced occurrence of pressure ulcers
Goodman 2018 (20)	Quality improvement project	Community Hospital (Canada)	Inpatients that developed HAPIs	HAPI prevention equipment Staff education/training Continence promotion PU risk assessment Electronic documentation	Reduced occurrence of pressure ulcers for non-ICU patients only
Gupta 2020 (21)	Quality improvement project	Tertiary cardiac hospital (Qatar)	Inpatients	SSKIN bundle audit Skin care Repositioning Pressure support surfaces Electronic documentation Nutritional assessment Staff training/education	Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers Improved outcomes for patients

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
Gu 2022 (22)	Multi-component intervention	Hospital (China)	Inpatients	MDT approach Communication established	Reduced severity of pressure ulcers Reduced harm of pressure ulcers Improved outcomes for patients
Heywood 2015 (23)	Multi-component intervention	Acute hospital (UK)	Inpatients	SSKIN bundle: Pressure support surfaces Skin care Mobilisation Continence care Nutritional assessment	Reduced occurrence of pressure ulcers Improved outcomes for patients
Holbrook 2021 (24)	Quality improvement project	3-bed hospital ward (Australia)	Medical and oncology inpatients	Staff training/education Pressure support surfaces	Improved outcomes for patients Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers
Hu 2022 (25)	Multi-component intervention	Hospital and surrounding health service centres and community (China)	Older people in hospital, care homes or accessing health centres	PU prevention and management training centres established Staff training/education Rapid transmission and information network established PU care records created	Improved outcomes for patients Reduced occurrence of pressure ulcers Reduced harm of pressure ulcers
Jafary 2018 (26)	Stepped-wedge, cluster randomised controlled trial	Hospital (Iran)	Inpatients assessed as high-risk of PUs	Patient education Staff training/education Bedside cards	Reduced occurrence of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
				Skin care Repositioning Pressure support surfaces WOC ward rounds	
Kriesberg 2018 (27)	Quality improvement project	Paediatric cardiac care unit (USA)	Children	Staff training/education Evidence-based PU prevention and management protocol	Reduced occurrence of pressure ulcers
Lavallée 2019 (28)	Mixed-methods feasibility study	Nursing home (UK)	Older adults	Pressure ulcer care bundle: Pressure support surfaces Skin inspection Repositioning Staff training/education PU risk assessment	Reduced occurrence of pressure ulcers
Loudet 2017 (29)	Quality improvement project	ICU in a University hospital (Argentina)	ICU patients	Staff training/education Staff communication Patient's family training	Improved outcomes for patients Reduced severity of pressure ulcers Reduced occurrence of pressure ulcers
Luton 2018 (30)	Multi-component intervention	Paediatric hospital (USA)	Children	Skin assessment Device rotation Repositioning Appropriate bed surface	Reduced occurrence of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
				Moisture management Skin champion team	
Mackie 2014 (31)	Multi-component intervention	102 Hospital wards (UK)	Inpatients	Infrastructure Evidence-informed practice Clinical quality indicator compliance Clinical documentation Pressure support surfaces SKIN Bundle	Reduced occurrence of pressure ulcers
Mallah 2015 (32)	Prospective descriptive research design	Tertiary medical center (Lebanon)	Inpatients	PU risk assessment PU staging Nursing champions Staff education/training Electronic reporting of PUs INTACT bundle implemented: continence, nutrition, skin assessments, MDT and linens.	Reduced occurrence of pressure ulcers
Mietzsch 2019 (33)	Quality improvement project	NICU (USA)	NICU patients	Caregiver education Communication Neonatal neuromonitoring toolkit implementation	Reduced occurrence of pressure ulcers Improved outcomes for patients Reduced severity of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
Moyer 2022 (34)	Quality improvement project	NICU (USA)	Children	QI taskforce established PI prevention care bundle Staff education/training Development of EEG monitoring bundle	Reduced occurrence of pressure ulcers
Richardson 2017 (35)	Quality improvement project	4 Adult CCUs (UK)	Adult CCU patients	Staff education/training Development of PU guidelines Pressure support surfaces Risk assessment tools PU prevalence surveillance PU prevention care guidance	Reduced occurrence of pressure ulcers Improved outcomes for patients Reduced severity of pressure ulcers
Romito 2023 (36)	Quality improvement project	Military Medical Treatment Facility (USA)	Perioperative patients	PU risk assessment Staff education/training Silicone dressing MDT approach	Reduced occurrence of pressure ulcers
Simsic 2019 (37)	Quality improvement project	PICU (USA)	Children	MDT approach Hospital-wide skin bundle implemented: Skin care Repositioning Pressure support surfaces WO nurse reviews all PUs	Reduced occurrence of pressure ulcers Improved outcomes for patients Reduced severity of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
Singh 2023 (38)	Quality improvement project	Hospital (USA)	Immobile patients	Staff training/education WO nurse lead PU prevention PU identification Policies and guidance updated Pressure support surfaces	Reduced occurrence of pressure ulcers Improved outcomes for patients Reduced severity of pressure ulcers
Tayyib 2017 (39)	2-arm RCT	2 Tertiary Hospitals (Saudi Arabia)	Inpatients	PU risk assessment Skin assessment Skin care Nutritional assessment Staff training/education Pressure support surfaces Repositioning	Reduced occurrence of pressure ulcers Reduced severity of pressure ulcers
Tinker 2020 (40)	Quality improvement project	ICU in a Tertiary Hospital (Australia)	Adult ICU patients	Communication Skin care PU risk assessment PU pathway implemented	Reduced severity of pressure ulcers
Waird 2021 (41)	Quality improvement project	High-level care facility (Australia)	Residents aged >70 years	Staff training/education Skin assessment	Reduced severity of pressure ulcers
Woodhouse 2014 (42)	Multi-component intervention	Community and outpatient settings (UK)	Patients accessing community	Staff education/training on skin care, equipment use and PU management.	Reduced occurrence of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
			hospitals and district nursing support		
Wood 2019 (43)	Quality improvement project	13 healthcare organisations across North East and North Cumbria: Secondary care, community services, care homes and ambulance service (UK)	Inpatients, outpatients and residents	Staff training/education	Reduced occurrence of pressure ulcers Improved outcomes for patients
Wu 2023 (44)	Quality improvement project	A Tertiary Comprehensive Hospital (China)	Inpatients with transnasal tubes	QI team established Guidelines for TTPIS Staff training/education Information management	Reduced occurrence of pressure ulcers Improved outcomes for patients
Yilmazer 2019 (45)	Quality improvement project	Nursing Home (Turkey)	Older residents	PU auditing and monitoring Staff education/training PU management protocol implemented	Reduced occurrence of pressure ulcers
Yilmazer 2022 (46)	Multi-component intervention	Neurosurgery ICU in a University Hospital	ICU patients	PU auditing and monitoring Staff education/training	Reduced occurrence of pressure ulcers

StudyID Author, *year (reference)*	Study design	Setting (Country)	Population	Intervention/QI components	Outcomes
		(Turkey)		PU management protocol implemented	
Young 2015 (47)	Quality improvement project	Long-term care Acute Hospital (USA)	Long-term care patients	Staff education/training Wound care team established PU monitoring and reporting Staff communication	Reduced occurrence of nonsocomial pressure ulcers
Yu-Tsung 2015 (48)	Quality improvement project	Wound Care Center (Taiwan)	Wound care inpatients and outpatients	Wound debridement Wound re-evaluation Tailored wound care plan	Improved outcomes for patients

*RN- registered nurse, CCU – critical care unit, ICU – intensive care unit, PT – physical therapist, PU – pressure ulcer, PI – pressure injury, MDT – multidisciplinary team, HAPI – hospital acquired pressure ulcer, QI – quality improvement, PICU – paediatric intensive care unit. WO – wound ostomy, RCT – randomized controlled trial, TTPI – transnasal tube-related pressure injuries.

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Appendix 1

Cochrane Library Search Strategy

Date Run: 26/03/2024 19:31:41

Comment:

ID	Search	Hits
#1	MeSH descriptor: [Pressure Ulcer] explode all trees	1049
#2	(pressure NEXT ulcer*):ti,ab,kw	1968
#3	(pressure NEXT injur*):ti,ab,kw	365
#4	(decubitus NEXT ulcer*):ti,ab,kw	179
#5	(deep NEXT tissue NEXT injur*):ti,ab,kw	13
#6	(bedsore*):ti,ab,kw	141
#7	(#1OR#2OR#3OR#4OR#5OR#6)	2273
#8	(quality NEXT improv*):ti,ab,kw	4293
#9	(evidence NEXT base* NEXT practice*):ti,ab,kw	3949
#10	(interven*):ti,ab,kw	596109
#11	(prevent*):ti,ab,kw	289088
#12	(manag*):ti,ab,kw	184216
#13	(treat*):ti,ab,kw	1064096
#14	#8OR#9OR#10OR#11OR#12OR#13	1486899
#15	(improv*):ti,ab,kw	521883
#16	(recover*):ti,ab,kw	88607

#17 (reduc*):ti,ab,kw 524157

#18 (harm* NEXT reduc*):ti,ab,kw 739

#19 (improv* NEXT outcome*):ti,ab,kw 13225

#20 (sever*):ti,ab,kw 301108

#21 #15OR#16OR#17OR#18OR#19OR#20 1025215

#22 #7AND#14AND#21 with Cochrane Library publication date Between Jan 2014 and Mar 2024, in Cochrane Reviews, Trials, Clinical Answers, Editorials 824