



Interventions Table: Pressure Ulcers

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Introduction

The purpose of this Interventions Table is to provide a succinct overview of information published during the past six years regarding successful or potentially successful interventions to prevent and/or treat pressure ulcers. Some citations may not be actual studies of specific interventions, but are included, as they provide important information or commentaries regarding relevant publications. The genres of citations include editorials, observational studies, informational publications, randomized control trials, and reviews of multiple published articles. Citations are grouped and alphabetized by type of intervention (see Table of Contents for listing of interventions). The project team conducted a search of the MedLINE and PubMed databases via OVID for articles written in English within the most recent six-year period (2004 – 2009), acknowledging the fact that 2009 publications do not encompass the entire year. Medical Subject Headings (MeSH) keywords used in the database searches are listed below:

- Nursing home + pressure ulcer + intervention
- Nursing home + pressure ulcer + intervention + resident outcomes
- Nursing home + pressure ulcer + outcomes
- Nursing home + pressure ulcer + review
- Nursing home + pressure ulcer + systematic review
- Nursing home + pressure ulcer + skin assessment
- Nursing home + pressure ulcer + skin assessment + resident
- Nursing home + pressure ulcer + risk assessment
- Nursing home + pressure ulcer + repositioning
- Nursing home + pressure ulcer + repositioning + resident
- Nursing home + pressure ulcer + pressure relief
- Nursing home + pressure ulcer + turning
- Nursing home + pressure ulcer + resident
- Nursing home + pressure ulcer + medical honey
- Nursing home + pressure ulcer + daily skin check
- Pressure ulcer + nutrition + review
- Pressure ulcer + treatment + resident outcomes
- Pressure ulcer healing + literature review

Highlights from the citations are presented in the Interventions Table. The information noted in the table is not intended to provide a comprehensive summary of each citation. The full articles should be referenced for complete information. In addition, other citations may be available that are not represented in this table.

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The evidence rating, based on review criteria from Cochran¹, Agency for Healthcare Research and Quality (AHRQ)², and Grading of Recommendations, Assessment, Development, and Evaluation (GRADE)³, is designated by use of three categories: *Excellent* (providing the strength of a randomized control trial), *Moderate* (e.g., observational or retrospective study), or *Limited* (e.g., case study, opinion piece, or small sample). Ratings were determined relative to the strength of evidence found in specific publications and not applied to the overall strength of evidence of the type of intervention. When clear delineation of evidence rating was not evident, ratings were applied based on consensus of the project team.

¹ Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.0.1 [updated September 2008]. The Cochrane Collaboration, 2008. Available from www.cochrane-handbook.org.

² Systems to Rate the Strength of Scientific Evidence: No. 47. Rockville, MD: Agency for Healthcare Research and Quality. AHRQ Publication No. 02-E015 (Contract 290-97-0011 to the Research Triangle Institute); 2002.

³ Guyatt GH, et al. GRADE: An Emerging Consensus on Rating Quality of Evidence and Strength of Recommendations. *BMJ*. Apr2008;336:924-6.

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Abbreviations

The following abbreviations are found throughout the table:

Abbreviation or symbol	Meaning
↑	increase or increased
↓	decrease or decreased
<	less than
>	greater than
avg	average
CLP	constant low pressure
CNA	Certified Nursing Assistant
DON	Director of Nursing
hrs	hours
LTACH	long term acute care hospital
LTC	long term care
MDS	Minimum Data Set
mgmt	management
NH	nursing home
nsg	nursing
PR	physical restraint
PU	pressure ulcer
QI	Quality Indicator
QM	Quality Measure
RAS	Risk Assessment Scales
RCT	Randomized Control Trial
re	regarding
vs	versus
w/	with
wks	weeks
yr	year

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p>Barriers to Clinical Practice Guideline (CPG) Implementation</p>	<p>Colon-Emeric, et al. 2007⁴</p> <p>Limited - Qualitative survey analysis; substudy of larger study of 8 NH; small sample.</p>	<p>N=35 staff from 4 randomly selected NHs including:</p> <ul style="list-style-type: none"> • Physicians • Nurse practitioners • Administrative staff • Nurses • Certified Nursing Assistants (CNAs). <p>Aim: Identify barriers to & facilitators of the diffusion of clinical practice guidelines (CPGs) & clinical protocols in NH</p>	<p>Semi-structured interviews conducted to determine:</p> <ul style="list-style-type: none"> • Awareness of & attitudes toward CPGs • Barriers to or facilitators of adoption to clinical protocols. 	<ul style="list-style-type: none"> • Only 3/35 providers were familiar w/ CPGs. • Confusion w/other documents & regulations was common. <p>Most frequently cited barriers:</p> <ul style="list-style-type: none"> • CPGs were “checklists” to replace clinical judgment • Perceived conflict w/resident & family goals • Limited facility resources • Lack of communication between providers & across shifts • Facility policies that overwhelm or conflict w/CPGs • HIPAA interpreted to limit CNA access to clinical info
<p>Best Practice-Management</p>	<p>Joanna Briggs Institute (JBI)⁵</p> <p>Moderate to Excellent – Best practice summary, evidence grading</p>	<p>Summary & grading of evidence from:</p> <ol style="list-style-type: none"> 1. JBI information sheet, 1997⁶ 2. Clinical Practice Guidelines from the Royal College of Nsg & National Institute for Health & Clinical Excellence,2005⁷ 	<p>Best practice sheet: PUs – management of pressure related tissue damage: http://www.joannabriggs.edu.au/pdf/BP_Book_Vol12_3.pdf</p> <p>PU Management Technical report: http://www.joannabriggs.edu.au/pdf/TR_2008_4_3.pdf</p>	<p>Recommendations (all w/moderate support):</p> <ul style="list-style-type: none"> • Optimal mgmt requires comprehensive & accurate assessment of wound history, etiology recurrence & characteristics • Grade 1-2 PUs should be place on high specification mattress or cushion w/ pressure reducing capabilities w/ close observation of skin changes & documented repositioning regime • If deterioration from 1-2 or if grade 3-4: alternating pressure or CLP system should be implemented • Dressings (such as hydrocolloids) create an environment most optimal for wound healing • Patients w/ PUs should actively mobilize, change position independently or be repositioned as clinically indicated

⁴ Colón-Emeric CS, et al. Barriers to and Facilitators of Clinical Practice Guideline Use in Nursing Homes. *JAGS*. 2007 Sept; 55(9): 1404–1409.

⁵ JBI Pressure ulcers – management of pressure related tissue damage *Best Practice* 12(3) 2008. Issn: 1329-1874.

⁶ The Joanna Briggs Institute. Pressure Sores – Part II: Management of Pressure Related Tissue Damage. *Best Practice: evidence-based practice information sheets for health professionals* 1997;1(2):1-6.

⁷ The management of pressure ulcers in primary and secondary care. A Clinical Practice Guideline, 2005 Royal College of Nursing and National Institute for Health and Clinical Excellence.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Best Practice-Prevention	Joanna Briggs Institute (JBI) ⁸ Moderate to Excellent - Best practice summary, evidence grading	Summary & grading of evidence from 4 systematic reviews: 1. Pancorbo-Hidalgo, et al. 2006 ¹ 2. Reddy, et al. 2006 ⁵ 3. Cullum, et al. 2004 ⁹ 4. Langer, et al, 2003 ¹⁰ Additional Summary of Best Practice evidence including JBI ¹¹	Best practice sheet: PUs – prevention of pressure related damage: https://www.joannabriggs.edu.au/pdf/BP_Book_Vol12_2.pdf PU Prevention Technical report: http://www.joannabriggs.edu.au/pdf/TR_2008_4_2.pdf	Conclusions: • PUs are in many cases preventable • A targeted prevention approach less costly than one focused on treating already established ulcers
Best Practice - Protocol Implementation (Hospital)	Griffin, et al. 2007 ¹² Limited – Hospital case study	n=1 medical center w/ PU incidence rate of 9.4% at baseline Aim: Implement a PU prevention protocol to ↓ PU incidence by 50%	Skin breakdown prevention protocol • Total skin assessment every 24 hrs • Moisture mgmt for incontinence w/ dry flow pads, moisture barriers, skin sealants & fecal incontinence pouches • Braden Scale on admission & every 24 hrs • Pressure redistribution mattresses for all patients • Low-air loss bed if Stage III or IV • Scheduled audible reminders to turn patients • Save Our Skins (SOS) prompts • SOS champion for each unit • PUs reported as “never events” • “Lift team” rounds hospital every 2 hrs to help mobilize patients • Monthly meeting of interdisciplinary team led by WOCN nursing • Pt & family education • Performance audits	Outcomes: • Hospital-acquired PUs ↓ from 9.4 to 1.5% in 5 yrs • Implementation of comprehensive PU prevention program has demonstrated sustained improvements • Evidence based care benefits noted: ➢ ↑ pt safety through ↑ care quality ➢ ↓ healthcare costs from pt complications ➢ Enhanced staff satisfaction from streamlined work processes & knowing they’re providing optimal pt care Ongoing program targets: • ↓ # PU cases • Improving pt safety • ↑ service quality • Limiting complications due to hospital acquired PUs • Reducing costs by >\$3 million annually

⁸ JBI Pressure ulcers – prevention of pressure related damage *Best Practice* 12(2) 2008. Issn: 1329-1874.

⁹ Cullum NA, et al. Support surfaces for Pressure Ulcer Prevention. Cochrane Database of Systematic Reviews 2004, Issue 3.

¹⁰ Langer G, et al. Nutritional interventions for preventing and treating pressure ulcers. Cochrane Database Syst Rev. 2003;(4):CD003216

¹¹ Pressure Ulcers –prevention of pressure related damage. Aust Nurs Journ. 2008 May;15(10):22-29.

¹² Griffin B, et al. Reducing Harm From Pressure Ulcers. Nursing Management 2007 Sept:29-32.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Best Practice- Topical Skin Care	Joanna Briggs Institute (JBI) ¹³ Moderate to Excellent - Best practice summary and evidence grading	Summary & grading of evidence from systematic review by Hodgkinson and Nay, 2005 ¹⁴	Best practice sheet – Topical skin care in aged care facilities: http://www.joannabriggs.edu.au/pdf/BPISEng_11_3.pdf Topical Skin Care Technical Report http://www.joannabriggs.edu.au/pdf/TR_2007_3_3.pdf	‘Best’ evidence for practical clinical care suggests that: <ul style="list-style-type: none"> • Disposable bodyworn will guard against skin deterioration • No-rinse cleansers preferable to soap & water to ↓ PU & skin dryness, no evidence exists for use to prevent skin tears • Sudocrem may ↓ skin redness over zinc cream alone • No recommendation on safety of any intervention as safety was not evaluated in any included study
Best Practice- Wound Cleaning	Joanna Briggs Institute (JBI) ¹⁵ Moderate to Excellent - Best practice recommendations and evidence grading	Summary & grading of evidence from systematic review of: 1. JBI, 2003 ¹⁶ 2. Fernandez et al. 2004 ¹⁷	Best practice sheet – Wound cleaning: http://www.joannabriggs.edu.au/pdf/BPISEng_10_2.pdf Wound Cleaning Technical Report http://www.joannabriggs.edu.au/pdf/TR_2006_2_2.pdf	<ul style="list-style-type: none"> • Potable tap water may be appropriate cleansing solution if saline not available • Boiled & cooled tap water effective for cleansing in absence of saline • Irrigation with 1% povidone-iodine is effective in ↓ infection rate in contaminated wounds. • Pressures of 13 psi effective in ↓ infection & inflammation w/ lacerations & traumatic wounds. • Showering patients does not impact infection & healing rates of postoperative wounds; may benefit patients w/feeling of well-being, health, cleanliness. • Showering for cleaning ulcers & other chronic wounds should be undertaken with caution. • Whirlpool therapy may ↓ pain & inflammation in surgical wounds & ↑ PU healing rate • Soaking in 1 % povidone-iodine not effective in ↓ bacterial count

¹³ JBI Topical Skin Care in Aged Care Facilities *Best Practice* 11(3) 2007. Issn: 1329-1874.

¹⁴ Hodgkinson B and Nay R. Effectiveness of topical skin care provided in aged care facilities. *Int J Evid Based Healthc* 2005; 3(4):65-101.

¹⁵ JBI Solutions, techniques and pressure in wound cleaning *Best Practice* 10(2) 2006. Issn: 1329-1874.

¹⁶ JBI Solutions, techniques and pressure in wound cleaning *Best Practice* 7(1) 2003. Issn: 1329-1874

¹⁷ Fernandez R, et al. Effectiveness of solutions, techniques and pressure in wound cleansing. 2004 JBI Reports 2(7), 231-270

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
	AHRQ/Horn, 2009 ¹⁸ Moderate to Excellent – Literature review, note link w/citation below	Summary of 6 studies related to nutritional interventions (78 studies reviewed): <ul style="list-style-type: none"> • Citation • Setting • Sample • Design • Results & conclusions <p>Aim: Review of literature to summarize existing evidence about treatments to ↑ PU healing.</p>	Intervention topics assessed include: <ul style="list-style-type: none"> • Nutrition • Support surfaces • Wound debridement • Skin cleansers • Hydrocolloids/wound dressings • Other adjunctive therapies • Topical agents, growth factors & skin equivalents • Bacterial control • Vacuum assisted closure • Negative Pressure Wound Therapy (NPWT) 	<p>Nutritional Intervention Results & Conclusions:</p> <p>Bergstrom & Braden, 1990:</p> <ul style="list-style-type: none"> • Monitoring nutritional status & ensuring adequate intake may help prevent & heal PUs faster • Patients w/out PUs & w/PUs that healed had higher caloric intake than those w/non-healing PUs • Patients w/non-healing PUs had lower intake of zinc <p>Breslow, et al 1993: dietary protein 61g protein/L</p> <ul style="list-style-type: none"> • ↓ in PU area was significantly correlated w/dietary protein intake & caloric intake • ↑ protein intake ↑ wound healing <p>Van Rijswijk & Polansky, 1994: good nutritional status at baseline ↓ healing time significantly</p> <p>Welch, et al. 1991: Indirectly demonstrates efficacy of nutrient supplements in the few PU patients included to promote ↑ in albumin & PU healing</p>
Nutrition	Lee, et al. 2006 ¹⁹ Excellent-RCT (Also reviewed by Cullum, 2008 & AHRQ/Horn)	23 NHs w/ 89 residents w/ 132 stage II, III or IV PUs (71 residents w/108 PUs at completion) randomized to: <ul style="list-style-type: none"> • Intervention (n = 56 res; 44 residents at completion w/ 75 PUs) • Control (n = 33 res; 27 residents at completion w/33 PUs) <p>Exclusions: (a) terminal diagnosis; (b) hospice care; (c) a protein-restricted diet due to renal insufficiency; (d) active metabolic or gastrointestinal diseases that might interfere with nutrient absorption, distribution, metabolism, or excretion (e) food allergies; or (f) use of corticosteroids or antibiotics for wound infection.</p> <p>Aim: evaluate efficacy of a concentr, fortified, collagen protein hydrolysate supplement in LTC residents w/ PUs</p>	<p>Intervention = standard care plus a concentrated, fortified, collagen protein hydrolysate supplement</p> <p>Control = standard care plus placebo</p> <p>Administered (intervention or placebo)</p> <ul style="list-style-type: none"> • 1.5 fl oz doses orally or via feeding tube • 3 times daily for 8 weeks <p>Wound healing assessed biweekly using the PUSH Tool.</p> <p>Outcome measure – change in PUSH scores at 8 wks</p>	<ul style="list-style-type: none"> • After 8 weeks of treatment, intervention group had statistically significant mean ↓ in PUSH tool scores compared w/ placebo (60% reduction vs. 48% reduction) • PUSH tool scores showed approximately twice the rate of PU healing in treatment group compared w/ control group • A concentrated, fortified, collagen protein hydrolysate supplement may benefit LTC residents w/ PUs

¹⁸ Horn SD. *On-Time Pressure Ulcer Healing Project: Literature Review*. July 2009. Agency for Healthcare Research and Quality, Rockville, MD.

<http://www.ahrq.gov/research/pressureulcerhealing/pruhlit.htm>

¹⁹ Lee SK, et al. Pressure Ulcer Healing with a Concentrated, Fortified, Collagen Protein Hydrolysate Supplement: A Randomized Controlled Trial. *Adv Skin Wound Care*. 2006 Mar;19(2):92-6.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Nutrition (continued)	Schols, et al. 2009 ²⁰ Moderate to Excellent – Literature review	6 RCTs or clinical trials (CTs) w/ Oral Nutritional Supplement (ONS) enriched w/ arginine, vitamin C, & zinc Aim: Examine effect of nutritional intervention in PU care	Review of electronic & conference databases from 1997- Oct 2008: <ul style="list-style-type: none"> • 4 studies (2RCTs, 2CTs) examined effects of ONS in patients w/ PUs • 2 studies (1RCT, 1CT) examined effects of ONS in patients at high risk of developing 	<ul style="list-style-type: none"> • The ONS specifically developed for patients w/ PUs show positive effects on PU healing • The ONS might potentially ↓ the risk of developing PUs.
Other Adjunctive Therapies for PU Healing	AHRQ/Horn, 2009 ²¹ Moderate to Excellent – Literature review, note link w/citation below	Summary of (78 studies reviewed): <ul style="list-style-type: none"> • 7 studies re other adjunctive therapies • 3 studies re topical agents, growth factors & skin equivalents • 6 studies re bacterial control • 3 studies re vacuum assisted closure Aim: Review of literature to summarize existing evidence about treatments to ↑ PU healing.	Intervention topics assessed include: <ul style="list-style-type: none"> • Nutrition • Support surfaces • Wound debridement • Skin cleansers • Hydrocolloids/wound dressings • Other adjunctive therapies • Topical agents, growth factors & skin equivalents • Bacterial control • Vacuum assisted closure • Negative Pressure Wound Therapy (NPWT) 	Other adjunctive therapies Results & Conclusions: Decubitus direct current treatment (DDCT): <ul style="list-style-type: none"> • DDCT treatment for stage III PUs, with conservative wound care may accelerate healing process during the first period of care (Adunsky, et al 2005) Low intensity direct current <ul style="list-style-type: none"> • Faster healing rates in intervention group: enhanced healing with low-intensity direct current treatment (Carley, et al 1985) Monophasic pulsed electric stimulation <ul style="list-style-type: none"> • Avg healing rate of 14%/wk in treatment group was significantly better than 8.25% in control group (Feedar, et al 1991) • Treated PUs healed more than twice as much as control. (Gentzkow, et al 1991) Dermagran dual therapeutic system <ul style="list-style-type: none"> • At 6 weeks, the active combination group showed a 90.7% improvement in ulcer size compared with 4.8% for placebo, 6.7% active spray alone, and 25.9% active ointment alone (Guthrie M, 1989) Topical Nerve Growth Factor (NGF) <ul style="list-style-type: none"> • Avg ↓ in PU area greater in intervention group receiving topical NGF than in control (Landi F, et al 2003)

²⁰ Schols JMGA, et al. Nutritional support in the treatment and prevention of pressure ulcers: An overview of studies with an arginine enriched Oral Nutritional Supplement. J Tissue Viability. 2009 Aug;18(3):72-9. Epub 2009 May 8.

²¹ Horn SD. *On-Time Pressure Ulcer Healing Project: Literature Review*. July 2009. Agency for Healthcare Research and Quality, Rockville, MD.

<http://www.ahrq.gov/research/pressureulcerhealing/pruhlit.htm>

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p style="text-align: center;">Other Adjunctive Therapies for PU Healing (continued)</p>	<p>AHRQ/Horn (continued)</p>			<p>Bacterial control</p> <ul style="list-style-type: none"> • Treatment of stage I or II PUs w/ Balsam Peru, hydrogenated castor oil, and trypsin (BCT) ointment may ↓ treatment time & time to heal w/ potential ↓ in treatment-related nsg labor costs (Narayanan S, et al 2005) <p>Vacuum Assisted Closure (VAC)</p> <ul style="list-style-type: none"> • 32% of PUs healed completely in 2-16 wks & 46% closed more than 80%. No PUs recurred at original wound site. (Argenta LC, et al 1997) • VAC therapy was able to heal wounds in a significantly shorter period of time than alginate & hydrocolloid dressings (Smith N, 2004)

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p style="text-align: center;">Pressure Relieving Support Surfaces</p>	<p>AHRQ/Horn, 2009²²</p> <p>Moderate to Excellent – Literature review, link w/citation below</p>	<p>Summary of 10 studies re support surfaces (from total of 78 studies reviewed) including:</p> <ul style="list-style-type: none"> • Citation • Setting • Sample • Design • Results & conclusions <p>Aim: Review of literature to summarize existing evidence about treatments to ↑ PU healing.</p>	<p>Intervention topics assessed include:</p> <ul style="list-style-type: none"> • Nutrition • Support surfaces • Wound debridement • Skin cleansers • Hydrocolloids/wound dressings • Other adjunctive therapies • Topical agents, growth factors & skin equivalents • Bacterial control • Vacuum assisted closure • Negative Pressure Wound Therapy (NPWT) 	<p>Support Surface Intervention Results & Conclusions:</p> <p>Air Fluidized Beds/Supports:</p> <ul style="list-style-type: none"> • Significant median ↓ in PU surface area for patients w/air-fluidized beds compared to control (Allman, et al 1987) • Although air-fluidized beds can be used to treat PUs successfully, no simple criteria exist to predict which patients will benefit (Bennett, et al 1989) • Mean size of PUs in patients w/ air-fluidized mattresses ↓ while mean size of control patients' PUs ↑ over time (Munro, et al 1989) • Patients w/ PU on air-fluidized surfaces had statistically significant faster healing rates (particularly for stage III and stage IV ulcers) compared w/ patients on low air-loss & replacement mattresses (Ochs, et al 2005) <p>Low air-loss vs total contact seat:</p> <ul style="list-style-type: none"> • Faster healing & better function indicate that treatment using the generic total contact seat is superior to low-air-loss bed therapy (Rosenthal, et al 2003) <p>Low air loss beds:</p> <ul style="list-style-type: none"> • PU healing for residents on low-air-loss beds significantly better than w/ foam mattresses (Ferrell, et al 1993) <p>Pegasus Airwave System:</p> <ul style="list-style-type: none"> • Significantly ↑ signs of healing in patients using Pegasus airwave system (PAWS) for >5 days (St. Claire, 1992)

²² Horn SD. *On-Time Pressure Ulcer Healing Project: Literature Review*. July 2009. Agency for Healthcare Research and Quality, Rockville, MD.
<http://www.ahrq.gov/research/pressureulcerhealing/pruhlit.htm>

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Pressure Relieving Support Surfaces (continued)	McInnes, et al. 2008 ²³ Moderate to Excellent – Systematic review	N=52 RCTs found through systematic review through Feb, 2008. Inclusion criteria: RCTs <ul style="list-style-type: none"> Assessing effectiveness of beds, mattresses, mattress overlays, & seating cushions for PU prevention, any patient group in any setting Reporting an objective, clinical outcome measure Exclusion criteria: Studies only reporting proxy outcome measures Aim: (1) To what extent do pressure-relieving cushions, beds, mattress overlays and mattress replacements ↓ PU compared with standard support surfaces? (2) How effective are different pressure-relieving surfaces in preventing PUs, compared to one another?	<ul style="list-style-type: none"> Constant low pressure (CLP) supports vs Standard foam mattresses (SFM) Alternative Foam Mattress vs SFM Alternative Foam Supports Comparisons between CLP Supports Alternating Pressure (AP) devices vs SFM AP devices vs CLP AP devices vs silicone or foam overlay AP devices vs water or static air mattress AP & CLP in ICU/Post ICU Alternating Pressure Devices Low Air Loss vs Standard Bed Air-Fluidised Therapy vs Dry Flotation Kinetic Treatment Table vs Standard Operating Table Overlay vs No Overlay Micropulse System for Surgical Patients Seat Cushions 	<ul style="list-style-type: none"> Foam alternatives to the standard hospital foam mattress can reduce PU incidence in people at risk. The relative merits of alternating & constant low-pressure devices are unclear. One high quality trial suggests that alternating pressure mattresses may be more cost effective than alternating pressure overlays. Pressure-relieving overlays on the operating table have been shown to reduce postoperative pressure ulcer incidence, although two studies indicated that foam overlays resulted in adverse skin changes. Two trials indicated that Australian standard medical sheepskins prevented pressure ulcers. Insufficient evidence to conclude value of seat cushions, limb protectors and various constant low pressure devices as PU prevention strategies. Tentative indications that foot waffle heel elevators, a particular low air loss hydrotherapy mattress and two types of operating theatre overlays are harmful.
	Nicosia, et al. 2007 ²⁴ Moderate to Excellent – Literature review	n=14 studies w/ 1,457 patients from literature review of databases Jan 1980 - May 2005 for controlled clinical studies investigating the effect of pressure relief interventions w/ or w/out concurrent prevention programs on # of heel ulcers Aim: Investigate effectiveness of pressure-relieving interventions on the incidence of heel PUs in a variety of settings.	Heel ulcer incidence evaluated w/ <ul style="list-style-type: none"> 4 studies comparing air mattresses vs standard hospital mattresses 3 studies: foam mattresses vs w/ standard hospital mattresses (acute & LTC settings) 3 reports: # of heel ulcers w/ mattress overlays (only 1 compared heel ulcer occurrence w/standard hospital pillows) 2 reports: cost-effectiveness of mattresses with overlays to prevent heel ulcers 1 report: compared three different heel protection devices 1 report: compared heel protective device w/ standard hospital pillow 	<ul style="list-style-type: none"> Foam mattresses significantly ↓ risk of developing heel ulcers. 6/7 studies support use of air or foam mattresses/overlays to prevent heel PUs when compared w/ standard hospital mattress. Insufficient research to determine if heel-protective devices prevent heel PUs Results interpreted w/caution given relatively low # & poor quality of research articles available

²³ McInnes E, et al. Support surfaces for pressure ulcer prevention. Cochrane Database Syst Rev. 2008 Oct 8;(4):CD001735

²⁴ Nicosia G, et al. The effect of pressure-relieving surfaces on the prevention of heel ulcers in a variety of settings: a meta-analysis. Int Wound J. 2007 Sep;4(3):197-207. Review.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p>Pressure Relieving Support Surfaces (continued)</p>	<p>Vanderwee, et al. 2008²⁵</p> <p>Moderate to Excellent – Literature review</p>	<p>N=35 studies found through literature review of electronic databases through 2007.</p> <p>Most common outcome measures to evaluate effectiveness of alternating pressure air mattresses (APAM) were:</p> <ul style="list-style-type: none"> • PU incidence • Contact interface pressure • Blood perfusion <p>Aim: Examine and synthesize the literature on APAM as preventive measure for PUs.</p>	<ul style="list-style-type: none"> • 15 RCTs analyzed PU incidence • One RCT compared a standard hospital mattress with an APAM and found that the APAM was a more effective preventive measure. • Comfort of APAMs was primary outcome measure in only 4 studies. 	<ul style="list-style-type: none"> • APAMs are likely to be more effective than standard hospital mattresses • Contact interface pressure & blood perfusion give only a hypothetical conclusion about APAMs' effectiveness. • A number of technical problems associated with APAMs related to nurses' improper use of the devices. • Educating nurses in the correct use of APAMs is advisable. • RCTs comparing APAMs with constant-low-air mattresses resulted in conflicting evidence • No clear evidence as to which type of APAM performed better

²⁵ Vanderwee K, et al. Alternating pressure air mattresses as prevention for pressure ulcers: a literature review. Int J Nurs Stud. 2008 May;45(5):784-801. Epub 2007 Oct 4.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p>Prevention & Treatment of PUs</p>	<p>Cullum & Petherick, 2008²⁶</p> <p>Moderate to Excellent - Systematic review</p>	<p>n=60 systematic reviews, RCTs or observational studies from systematic review of databases through Feb, 2007.</p> <p>Summary & grading of evidence</p> <p>Aim: Answer the following questions:</p> <ol style="list-style-type: none"> 1. What are the effects of prevention interventions in people at risk of developing a PU? 2. What are the effects of treatments in people w/ PUs? 	<p>Preventative Interventions:</p> <ol style="list-style-type: none"> 1. Pressure Relieving surfaces (bed & chair) 2. Nutritional supplements 3. Repositioning 4. Topical lotions & dressings <p>Treatment Interventions:</p> <ol style="list-style-type: none"> 1. Pressure Relieving surfaces (bed & chair) 2. Debridement 3. Wound dressings 4. Electrotherapy 5. Low level laser treatment 6. Nutritional supplements 7. Surgery 8. Therapeutic Ultrasound 9. Topical negative pressure 10. Topical phenytoin 	<p>Key Points:</p> <ul style="list-style-type: none"> • Alternative foam mattresses (ie. viscoelastic foam) ↓ incidence of PUs compared to standard hospital foam mattresses, although not sure of best alternative • Low-air-loss beds: may ↓ risk of PUs compared w/ standard intensive-care beds • Medical sheepskin overlays may ↓ risk of PUs compared w/ standard care • Hydrocellular heel supports may ↓ risk of PUs compared w/ orthopaedic wool padding • Air-filled vinyl boots w/ foot cradles & low air-loss hydrotherapy beds may ↑ risk of PUs compared w/ other pressure-relieving surfaces <p>Prevention/Unknown effectiveness:</p> <ul style="list-style-type: none"> • Alternating pressure surfaces • Seat cushions • Electric profiling beds • Low-tech constant low pressure supports • Repositioning • Topical lotions & dressings • Nutritional supplements <p>Compared to standard care in people w/PUs:</p> <ul style="list-style-type: none"> • Air-fluidised supports may ↑ healing • Hydrocolloid dressings may ↑ healing <p>Treatment/Unknown effectiveness:</p> <ul style="list-style-type: none"> • Alternating pressure surfaces • Debriding agents • Low-tech constant low pressure supports • Low air-loss beds • Seat cushions • Dressings other than hydrocolloid • Topical phenytoin • Surgery • Electrotherapy • Ultrasound • Low level laser therapy

²⁶ Cullum, NA and E Petherick, et al. Pressure ulcers. Clin Evid (Online). 2008 Mar 19;2008. pii: 1901

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Prevention of Heel Ulcers	Walsh & Plonczynski, 2007 ²⁷ Excellent – RCT, prospective intervention study w/ control group design	n=242 hospital patients randomized to: <ul style="list-style-type: none"> • Intervention (n=46) • Control (n=196) Aim: Determine whether identification of comorbidities (plus daily Braden scale assessment and early aggressive pressure reduction interventions) would impact development of facility-acquired PUs (FAPUs) of the heel. Study: 4 phases: <ol style="list-style-type: none"> 1. Retrospective chart audit to identify factors predictive of skin breakdown 2. Two 10-day intervention periods 3. Prevalence day assessments of interventions vs control 4. Staff survey for effectiveness & satisfaction w/ products 	All groups: <ul style="list-style-type: none"> • Facility wide education • Revised protocol based on Braden score • Braden complete in first hrs of day shift • 2 hr turning schedule clocks in rooms • Waffle Heel Elevator Intervention group: <ul style="list-style-type: none"> • More frequent risk assessment w/ use of comorbidities & Braden scale • Assessment & documentation of heel skin integrity every 8 hours • Application of lotion daily • Notification of the wound care nurse if any PU developed. • Prevalon Pressure Relieving Heel Protector 	<ul style="list-style-type: none"> • Use of the Braden scale for predicting PU risk in conjunction w/ assessment of individual comorbidities is effective in ↓ risk of developing heel FAPUs • Early & aggressive implementation of pressure-relief & pressure-reducing products as part of the individual care plan is effective in prevention of heel FAPUs • Phase 2: No heel FAPUs were associated w/ the intervention. • Phase 3: 3 FAPUs occurred: 2 control group & 1 in intervention (pt not following intervention protocol). • Phase 4: significant preference to Prevalon Pressure Relieving Heel Protector effectiveness & pt/staff satisfaction w/ product
PU Prevention & Disparities	Rosen, et al. 2006 ²⁸ Moderate - Secondary analysis of previous study	All staff & residents from 136 bed non-profit NH Aim: Determine if educating NH staff about PU prevention ↓s differential risk of PU development in black & white NH residents 3 outcome measures: <ol style="list-style-type: none"> (1) Rate of emergent Stage I-IV PUs identified (2) Rate of emergent Stage II-IV PUs identified (3) Rate of individual residents developing at least 1 PU (Stages II-IV). 	Intervention: <ol style="list-style-type: none"> (1) Staff ability enhancement: <ul style="list-style-type: none"> • Computer-based interactive video educ program on PU prevention & early detection • Mandated use of penlights to promote early detection (2) Financial incentives: \$75/staff member if desired ↓ in PU incidence was achieved (3) Real-time mgmt feedback: information re adherence to the mandated training 	Baseline: <ul style="list-style-type: none"> • Black residents -higher rate of Stage II-IV PU emergence. • Black residents with any PU more likely to have multiple Stage II PUs compared w/ white res • 31.8% of PUs detected in white residents were Stage I, no Stage I PUs detected in black res Intervention period: <ul style="list-style-type: none"> • Rate of emergence of all PUs ↓ for both groups in similar trends. • Educintervention effectively ↓ rate of PUs for all residents & eliminated racial disparity noted at baseline.

²⁷ Walsh JS and Plonczynski DJ. Evaluation of a protocol for prevention of facility-acquired heel pressure ulcers. J Wound Ostomy Continence Nurs. 2007 Mar-Apr;34(2):178-83.

²⁸ Rosen J, et al. Pressure Ulcer Prevention in Black and White Nursing Home Residents: A QI Initiative of Enhanced Ability, Incentives, and Management Feedback. Adv Skin Wound Care. 2006 Jun;19(5):262-8.

Interventions Table: Pressure Ulcers

Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
PU Prevention & Disparities	Rosen, et al. 2008 ²⁹ Moderate – Further longitudinal analysis of Rosen, et al. 2006 ⁹	All staff & residents from 136 bed non-profit NH Aim: Determine sustainability of previously incorporated interventions to reduce PU rate	48 wk longitudinal study comparing incidence of PU in NH residents at baseline and post-intervention. Interventions of original study⁹: (1) Staff ability enhancement: (2) Financial incentives:\$75/staff member if desired ↓ in PU incidence was achieved (3) Real-time mgmt feedback: information re adherence to the mandated training	<ul style="list-style-type: none"> • Adherence to protocol and training compliance was 100% • Other intervention components not actively maintained • Significant reduction (P < .05) in the incidence of stage 2 or worse PUs during intervention period, but was lost during post-intervention period. <p>Conclusion: ↓ in PU unsustainable when 3 components of intervention not actively maintained</p>
PU Prevention Programs	Hiser, et al. 2006 ³⁰ Limited – Developed own project for 1 NH	580-bed regional medical facility Aim: Implement a team approach to performance improvement & develop education plan to prevent and treat PUs at one facility	<ol style="list-style-type: none"> 1. Lit review for evidence-based & best practices for PU prevention & treatment 2. Interdisciplinary wound care team 3. Formal nsg survey revealing many attitudes towards & misconceptions about PUs. 4. PU strategic plan developed to include: <ul style="list-style-type: none"> • Qrtly prevalence studies • Risk assessment based treatment plan – replaced Norton w/ Braden RAS • New PU Prevention Protocol (PUPP) • Clarify role of Certified Wound Ostomy Continence Nurse (CWO CN) • Education, training & development of infrastructure • New pressure relieving surfaces 	<ul style="list-style-type: none"> • Strategic planning & continuous performance improvement program significantly ↓ acquired PUs (from avg of 9.2% to avg of 6.6%) • Overall quality of pt care & use of financial resources improved substantially. • Staff members' attitudes reflect their belief that PUs are not inevitable. • CWO CN now seen as a resource & clinical expert. • Program ended early (2004) due to FL hurricanes
Quality Improvement & Collaboration	Abel, et al. 2005 ³¹ Moderate – Pre & post intervention study; convenience sample	n=20 NH in TX w/ full data (from convenience sample of 34 NHs) Aim¹⁴: Improve use of PU prevention procedures at NHs in TX through implementation of process of care system changes in collaboration w/QIO.	Process of care system changes w/ tools & educ to prevent pressure PUs Measure QIs & PU incidence rates Nov 2000- Aug 2002.	<ul style="list-style-type: none"> • PU incidence rates ↓ (not quite significantly) • NHs w/ greatest ↑ in QI scores had significantly lower PU incidence rates than NHs w/ least improvement in QI scores, suggesting that interventions positively affected process of care & led to ↓ in PU incidences

²⁹ Rosen J, et al. Ability, incentives, and management feedback: organizational change to reduce pressure ulcers in a nursing home. J Am Med Dir Assoc. 2008 Oct;9(8):594-8. Epub 9/7/08.

³⁰ Hiser B, et al. Implementing a pressure ulcer prevention program and enhancing the role of the CWO CN: impact on outcomes. Ostomy Wound Manage. 2006 Feb;52(2):48-59.

³¹ Abel RL, et al. Quality Improvement in Nursing Homes in Texas: Results From a Pressure Ulcer Prevention Project. J Am Med Dir Assoc. 2005 May-Jun;6(3):181-8.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
	<p>Gold & Shuxteau, 2005³²</p> <p>Limited – Case studies</p>	<p>NHs working with Quality Improvement Organizations (QIOs) during 2002 Nursing Home Quality Initiative (NHQI)</p> <p>NH #1: Windcrest NH working w/ TX QIO. NH #2: Parkview Nsg & Rehab working w/ DE QIO NH #3: NHC HealthCare Ft. Oglethorp working w/ FL QIO</p> <p>Aim¹³: Report on improvements made by individual NHs during the NHQI & Centers for Medicare & Medicaid Services (CMS) QIO pain collaborative</p>	<p>NH#1 received:</p> <ul style="list-style-type: none"> • Advice & encouragement about ↓ PUs. • Hands on educ & training by QIO • Data sharing • Onsite consultation • Publications <p>NH #2: Interdisciplinary team for prevention</p> <ul style="list-style-type: none"> • Dietary – health supplements • Rehab – positioning & mobility • Activities - stimulate interest • Housekeeping – clean environment • All staff educ to identify Stage 1 PUs. • Taking action on Stage 1 PUs <p>NH #3: Prevention is primary goal</p> <ul style="list-style-type: none"> • Full body assessment on admission • Preventative measures identified • Pressure relieving mattresses on all beds • Developed processes to identify problems & formulate solutions 	<p>NH#1:</p> <ul style="list-style-type: none"> • ↓ in # of PUs from 10.4 to 7.8% in 18 mos in targeted NHs • Review of PU protocol: <ul style="list-style-type: none"> ➤ Changed to pressure relieving mattresses ➤ Staff training on equipment use ➤ Instituted hydration processes ➤ Weekly skin meetings ➤ Diet considerations/adding supplements <p>NH #2:</p> <ul style="list-style-type: none"> • PUs ↓ from 10 to 5% in 18 mos. • One res. reports ↑ quality of life. • Now only Stage II PUs, no stage III or IV PUs. <p>NH #3: ↓ % of PUs from 12.2 to 5.8 in 2 yrs</p>

³² Gold MF and Shuxteau J. Teamwork Achieves Lower Pressure Ulcer, Pain Levels. Provider 2005, June: 23-42.

Interventions Table: Pressure Ulcers

Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p style="text-align: center;">Quality Improvement & Collaboration (continued)</p>	<p>Lynn, et al. 2007³³</p> <p>Moderate - CMS-led collaborative of quality improvement efforts to ↓ PU (National NH Improvement Collaborative or NNHIC)</p> <p>Also reviewed: Taller, 2007³⁴</p> <p>Limited – Editorial on NNHIC & Lynn, et al. 2007¹³</p>	<p>NNHIC: n=52 NH from 6 multi-state LTC corporations in 39 states & 29 quality improvement organizations (QIOs) led by Qualis Health in WA To participate, NHs must have:</p> <ul style="list-style-type: none"> • publicly reported PU QM data for 3rd quarter of 2003 • at least 75 certified beds <p>NNHIC Aims:</p> <ol style="list-style-type: none"> 1. Develop & test QI methods to ↓ PU incidence & prevalence 2. Test a national collaborative QI framework in NHs 3. ↓ PU incidence & prevalence among participating NHs 50% 4. Identify effective strategies, tools, & interventions 5. Encourage & estimate the diffusion of improvement methods & best practices in NHs. <p>NHs monitored monthly PU prevalence & incidence, healing & adoption of key processes via computerized registry.</p>	<p>Collaborative QI project.</p> <ul style="list-style-type: none"> • Quality improvement team from each NH attended 3 learning sessions & summary conference. <p>Learning sessions included:</p> <ul style="list-style-type: none"> • Faculty-led training & peer-to-peer sharing • Focus on QI methods • Measurement • PU prevention & treatment <p>Communication via:</p> <ul style="list-style-type: none"> • Learning sessions • Monthly conference calls • Email discussions • Final conference <p>Successful NNHIC Interventions: http://qualishealth.org/qi/collaboratives/upload/NH_%20Interventions.doc</p> <p>Successful Intervention themes:</p> <ul style="list-style-type: none"> • To ↑ community ties • To ↑ organizational commitment • To improve assessment & monitoring of PU • To improve PU prevention & treatment 	<ul style="list-style-type: none"> • At 35 regularly reporting NHs, total # of new nosocomial Stage III to IV PUs ↓ 69%. • Facility median incidence of Stage III to IV lesions ↓ from 0.3 per 100 occupied beds/month to 0.0 • Incidence of Stage II to IV lesions ↓ from 3.2 to 2.3 per 100 occupied beds/mo • Prevalence of Stage III to IV lesions trended down (from 1.3 to 1.1 res/100 occupied beds) • Improvement teams reported: Stage II lesions usually healed quickly & new PUs corresponded w/hospital transfer, admission, scars, obesity, and immobility & w/noncompliant, younger, or newly declining res • Results suggest that facilities can reduce incidence of Stage III to IV lesions & incidence of Stage II lesions may not correlate with the incidence of Stage III to IV lesions <p>NNHIC Tools: http://qualishealth.org/qi/collaboratives/NNHIC-Tools.cfm</p> <p>From Taller¹⁴ editorial:</p> <ul style="list-style-type: none"> • Critical of current PU staging for QI • Use incidence, not prevalence data to measure quality of care • Interdisciplinary effort at NH and cooperation across facilities is needed to prevent and treat PU • Need better metrics of healing

³³ Lynn J, et al. Collaborative Clinical Quality Improvement for Pressure Ulcers in Nursing Homes. J Am Geriatr Soc. 2007 Oct;55(10):1663-9. Epub 2007 Aug 21.

³⁴ Taller GA. A Clarion Call to Rethink Pressure Ulcers in America. J Am Geriatr Soc. 2007 Oct;55(10):1674-5.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Risk Assessment Scales (RAS)	Anthony, et al. 2008 ³⁵ Moderate to Excellent - Review Cited by ²	n=253 research or review papers Inclusion criteria: Papers using quantitative methods to evaluate RAS that included sensitivity, specificity, receiver operating characteristics, inter- and intra-rater reliability. Aim: Consider validity & reliability of RAS for PU	Review of literature from 1960-2006 Primary RAS reviewed: <ul style="list-style-type: none"> • Norton Scale • Braden Scale • Waterloo Scale 	<ul style="list-style-type: none"> • RAS may be helpful to identify patients who need higher levels of support. • Clinical judgment also useful in absence of RAS scores. • Implementation of RAS shown to ↓ PU incidence, but it is not clear if this is due RAS or the education and training to improve clinical judgment. • Contradictory evidence re RAS validity
	Two citations: (1) Pancorbo-Hidalgo, et al. 2006 ³⁶ Moderate to Excellent - Systematic review. 14 databases, cited by ² (2) Moore & Cowman, 2008 ³⁷ Moderate to Excellent - Review 1966-2008, no RCTs	33 studies including RCTs & prospective cohort studies. Retrospective studies excluded. Aim: Determine <ol style="list-style-type: none"> 1. Effectiveness of use of Risk Assessment Scales (RAS) for PU prevention in clinical practice 2. Degree of validation 3. Effectiveness as indicators of risk of developing a PU. 	Review of literature from 1966-2003 in 14 databases. Studies related to: Clinical effectiveness: 3 studies of RAS: all using Norton Scale. Validity: 22 studies of Braden Scale 7 studies of Waterloo Fewer than 7: Norton, Cubbin-Jackson, Modified Norton, Andersen, Douglas, Knoll, Pressure Sore Prediction Score, Risk Assessment Pressure Sore, Fraggment & Enima Risk Indicators: Used odds ratio (OR) as indicator of RAS's prediction capacity for PU development	<ul style="list-style-type: none"> • Confirmation of the lack of evidence establishing that the use of RASs ↓ PU incidence. • The Braden Scale has best validity & reliability indicators, & has been used in a large # of studies in a variety of settings. • The Braden Scale offers best risk estimate. • The Braden & Norton Scales predict PU development risk better than nurses' clinical judgment alone • The Waterloo Scale has good sensitivity but low specificity. • No RCT evidence available to identify whether applying a policy of conducting risk assessment makes any difference to PU incidence.²
	Papanikolaou et al. 2007 ³⁸ Moderate to Excellent- Review of RAS methods	Aim: Examine structure and scoring for Norton, Waterlow, and Braden RAS	Well known that RAS for PU are of limited value. This review focuses on reasons for these limitations and the scope for improving RAS	<ul style="list-style-type: none"> • The equal-weighting technique behind the current RAS is too simplistic & leads to limitations. • Properly trained, experienced nurses should conduct PU risk assessments, • More robust data-driven RAS should be developed using the differential weighting scoring method together with advanced statistical techniques.

³⁵ Anthony D, et al. Norton, Waterlow and Braden scores: a review of the literature and a comparison between the scores and clinical judgement. J Clin Nurs. 2008 Mar;17(5):646-53.

³⁶ Pancorbo-Hidalgo PL, et al. Risk assessment scales for pressure ulcer prevention: a systematic review. J Adv Nurs. 2006 Apr;54(1):94-110.

³⁷ Moore AEH and Cowman S. Risk assessment tools for the prevention of pressure ulcers. Cochrane Database Syst Rev. 2008 Jul 16;(3):CD006471.

³⁸ Papanikolaou P, et al. Risk assessment scales for pressure ulcers: a methodological review. Int J Nurs Stud. 2007 Feb;44(2):285-96. Epub 12/4/06.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Skin Care	AHRQ/Horn, 2009 ³⁹ Moderate to Excellent – Literature review, link w/citation below	Summary of 3 studies re skin cleansers (from total of 78 studies reviewed) including: <ul style="list-style-type: none"> • Citation • Setting • Sample • Design • Results & conclusions <p>Aim: Review of literature to summarize existing evidence about treatments to ↑ PU healing.</p>	Intervention topics assessed include: <ul style="list-style-type: none"> • Nutrition • Support surfaces • Wound debridement • Skin cleansers • Hydrocolloids/wound dressings • Other adjunctive therapies • Topical agents, growth factors & skin equivalents • Bacterial control • Vacuum assisted closure • Negative Pressure Wound Therapy 	<p>Skin Cleanser Significant Results & Conclusions:</p> <p>Thompson, et al. 2005:</p> <ul style="list-style-type: none"> • Implementation of skin care protocols that included use of a body wash & skin protectant ↓ incidence of stage I & II PUs & ↓ healing time <p>Weller, 1991: Dey-wash</p> <ul style="list-style-type: none"> • In > 80% of patients, Dey-Wash cleansed the wound of exudates & debris in less than half the time of the control group w/ bulb syringe method • Use of Dey-Wash cleanser is both efficient and effective

³⁹ Horn SD. *On-Time Pressure Ulcer Healing Project: Literature Review*. July 2009. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/research/pressureulcerhealing/pruhlit.htm>.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p style="text-align: center;">Skin Care (continued)</p>	<p>Voegeli, 2008⁴⁰</p> <p>Moderate to Excellent – Review</p> <p>Hodgkinson, et al. 2007⁴¹</p> <p>Moderate to Excellent – Systematic review of topical skin care; included in review by Vogeli</p>	<p>Review of current evidence based skin care interventions</p> <p>Aims:</p> <ol style="list-style-type: none"> 1. Explore essential components of skin care regimens 2. Consider current evidence to support interventions used 3. Discuss how evidence can be incorporated into practice <p>Hodgkinson, et al. 2007 Systematic review of databases from inception – April 2003 N=10 studies & 1 systematic review met criteria</p> <p>Including: non-medical interventions or programs designed to promote or improve the integrity of skin,</p> <p>Excluding: studies evaluating pressure relieving techniques to prevent PUs</p> <p>Aim: Evaluate the best available evidence regarding the effectiveness of topical skin care interventions for residents of aged care facilities.</p>	<p>Skin cleaning:</p> <ul style="list-style-type: none"> • Soap & water • Cleansing agents <p>Skin Hydration:</p> <ul style="list-style-type: none"> • Emollient <p>Skin protection:</p> <ul style="list-style-type: none"> • Barrier cream <p>Basic Skin Care Principles (Wound Ostomy & Continence Nurses Society 2003):</p> <ul style="list-style-type: none"> • Assess patient's skin daily • Cleanse skin when clinically indicated w/ pH balanced cleanser • Avoid using soap & hot water • Minimize skin exposure to moisture (e.g. incontinence, wound leakage) • Use skin barrier product (e.g. cream, ointment, film) to protect vulnerable skin • Use emollients to maintain skin hydration <p>Effectiveness of intervention on:³¹</p> <ol style="list-style-type: none"> 1. General skin condition; 2. Pressure sores; 3. Skin tears; 4. Dermatitis; 5. Dry skin. 	<p>Lack of quality evidence to support use of specific:</p> <ul style="list-style-type: none"> • Skin cleansers³¹ • Emollients - use largely based on pt preference or cost (Ellis, et al 2003) • Barrier creams (Hughes, 2002) <p>Potential benefits of defined skin care protocols:</p> <ul style="list-style-type: none"> • Incontinence protocol in NH led to improved skin health & integrity (Bale, et al. 2004) • Skin care protocols ↓ PU incidence rates in hospital & NH: <ul style="list-style-type: none"> ➢ PU rates ↓ from 17.9% to 2% over 3 yrs (Cole & Nesbit, 2004) ➢ 87% ↓ in PU incidence rate in 1 NH (Lyder, et al. 2002) <p>Small changes supported by ongoing educ can improve skin health</p> <p>Hodgkinson, et al. 2007:</p> <ul style="list-style-type: none"> • Disposable bodyworn may prevent skin deterioration • No rinse cleansers preferred over soap, may ↓ dryness & risk of PU • Avoid use of soap (except possibly emollient soap) • Use of bag bath may ↓ dry skin

⁴⁰ Vogeli D. Care or harm: exploring essential components in skin care regimens. Br J Nurs. 2008 Jan 10-23;17(1):24-30.

⁴¹ Hodgkinson B, et al. A systematic review of topical skin care in aged care facilities. J Clin Nurs. 2007 Jan;16(1):129-36.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p align="center">Skin Care (continued)</p>	<p>Bates-Jensen, et al. 2007⁴²</p> <p>Limited to Moderate – Descriptive, cohort study</p>	<p>N=35 residents from 2 NHs</p> <p>Aim: Examine the relationship between a measure of subepidermal moisture (SEM) & visual skin assessment (VSA) of erythema & Stage 1 PUs performed a week later in nursing home (NH) res.</p>	<p>Weekly concurrent Visual Skin Assessments (VSAs) & subepidermal moisture (SEM) ratings for 52 wks at:</p> <ul style="list-style-type: none"> • Sacrum • Right & left trochanters • Buttocks • Ischial tuberosities <p>SEM</p> <ul style="list-style-type: none"> • Measured using a handheld meter • Higher readings indicating greater SEM <p>VSA rated as:</p> <ul style="list-style-type: none"> • Normal • Erythema/Stage 1 PU • Stage 2+ PU 	<p>SEM:</p> <ul style="list-style-type: none"> • measures lowest for normal skin, higher for Stage 1 PU, highest for Stage 2+ PU across all sites • responsive to changes in VSA • higher SEM predicted greater likelihood of erythema/Stage 1 PU the next week • measures associated w/ concurrent erythema & PUs & future (1 week later) development of erythema/Stage 1 PUs • may assist in predicting early PU damage, allowing for earlier intervention
<p align="center">Staffing & Impact on PU Outcomes</p>	<p>Barry, et al. 2005⁴³</p> <p>Moderate - Stratified random sample; survey</p>	<p>156 NHs – survey of:</p> <ul style="list-style-type: none"> • DONs (n = 156) • Charge nurses (n = 430) <p>Aim: Examine moderating effect of staff stability on the relationship between management practices used to empower nurse aides & resident outcomes in a multistate sample of NHs</p>	<p>Management practices & nurse aide staff stability measures taken from a survey of DONs & day-shift charge nurses</p> <p>Resident outcome measures from MDS:</p> <ul style="list-style-type: none"> • Facility risk-adjusted PU incidence rates • Social engagement scores 	<ul style="list-style-type: none"> • ↑ # of rewards given to nurse aide staff associated w/ ↓ incidence of PUs • Situations where nurse aides had more influence in resident care decisions associated w/ higher aggregate social engagement scores. • Facilities experiencing low turnover & high retention associated w/ ↓ PU incidence; facilities w/ high turnover & high retention associated w/ higher social engagement scores.

⁴² Bates-Jensen BM, et al. Subepidermal Moisture Predicts Erythema and Stage 1 Pressure Ulcers in Nursing Home Residents: A Pilot Study. J Am Geriatr Soc. 2007 Aug;55(8):1199-205.

⁴³ Barry T, et al. Nurse Aide Empowerment Strategies and Staff Stability: Effects on Nursing Home Resident Outcomes. Gerontologist. 2005 Jun;45(3):309-17.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p style="text-align: center;">Systematic Review of PU Prevention</p>	<p>Milne, et al. 2009⁴⁴</p> <p>Limited - Pre-post intervention data based on single LTACH</p>	<p>108-bed long term acute care hospital (LTACH)</p> <p>Aim: ↓ perceived above-average PU prevalence rates & improve care processes in 1 LTACH by using a failure mode and effects analysis to identify and address high-priority areas for improvement</p>	<p>Identified areas in need of improvement:</p> <ol style="list-style-type: none"> 1. Lack of wound care professionals 2. Methods to consistently document prevention & wound data 3. Interdisciplinary wound care team approach 4. Have faulty electronic medical record <p>Interventions:</p> <ul style="list-style-type: none"> • New policies & procedures based on published guidelines • Creation of interdisciplinary wound care team • Improved assessment & documentation methods • Enhanced staff education • Revised electronic records • Wound care product reviews • Facility-wide commitment to improved care 	<ul style="list-style-type: none"> • Facility-acquired PU prevalence ↓ from 41% at baseline to 4.2% during the following 12 mos • Fewer missing electronic record data • Unknown applicability of LTACH to Skilled Nursing Facility

⁴⁴ Milne CT, et al. Reducing pressure ulcer prevalence rates in the long-term acute care setting. *Ostomy Wound Manage.* 2009 Apr;55(4):50-9.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p>Systematic Review of PU Prevention (continued)</p>	<p>Reddy, et al. 2006⁴⁵</p> <p>Moderate to Excellent - Systematic review (Cited by ¹⁷)</p> <p>(Also reviewed Joint Commission Report⁴⁶: summary of information from Reddy, et al 2006 & Leyder, 2003⁴⁷, as this provides additional information)</p>	<p>N=59 RCTs with 13,845 patients:</p> <ul style="list-style-type: none"> • 9,397 in acute care • 2,367 in LTC • 333 in rehab • 1,748 in mixed settings <p>Grouped into interventions that address:</p> <ol style="list-style-type: none"> 1. Mobility impairments (n=51 RCTs) including evaluation of: <ul style="list-style-type: none"> • Support surfaces (n=48 RCTs) • Repositioning (n=2 RCTs) • Exercise & incontinence treatment (n=1 RCT) 2. Nutrition (n=5 RCTs) 3. Skin health (n=3 RCTs) <p>Aim: Systematically review evidence examining interventions to prevent pressure ulcers</p>	<p>Systematic review of databases from inception through June 2006.</p> <p>Interventions for impaired mobility:</p> <ul style="list-style-type: none"> • Use of support surfaces • Mattress overlays on operating tables • Specialized foam & sheepskin overlays • Repositioning • Exercise & treatment of incontinence <p>Nutrition:</p> <ul style="list-style-type: none"> • Nutritional supplements <p>Impaired Skin Health:</p> <ul style="list-style-type: none"> • Topical agents to moisturize sacral skin 	<p>Support surfaces:</p> <ul style="list-style-type: none"> • Specialized foam & specialized sheepskin consistently superior to standard hospital mattress & ↓ PU incidence (multiple studies) • Seat cushions: foam & gel cushion more effective than specialized foam (Conine, et al. 1994) • 3 RCTs found dynamic support surfaces better than static, 1 not statistically significant • No difference between static & dynamic, but both better than standard surface (Andersen, et al. 1983) • No difference in PU incidence w/ dynamic support surface mattress overlay compared to dynamic support surface mattress (Nixon, et al. 1972); however cost evaluation suggested mattresses more cost effective & more acceptable to patients than overlays. <p>Repositioning – insufficient evidence to recommend specific regimen; however appropriate strategy for PU prevention</p> <p>Optimizing nutritional status & moisturizing sacral skin appropriate strategies for PU prevention</p>
<p>Target Setting</p>	<p>Baier, et al, 2008⁴⁸</p> <p>Moderate – Baseline & re-measure</p>	<p>n=7,091 volunteer NH using Setting Targets-Achieving Results (STAR) website to set targets for at least 1 of 2 QMs re PR & PU</p> <p>Aim: Evaluate improvement among NH that set targets using NH STAR Site for 2 QMs</p>	<p>NHs using STAR site to set targets re:</p> <ol style="list-style-type: none"> 1. Proportion of long-stay residents who w/ daily PR use 2. Proportion of high-risk long-stay residents who have PUs <p>NH used STAR site to evaluate clinical performance, identify targets & track achievement of targets</p>	<ul style="list-style-type: none"> • Greater relative improvement in PU QM for NHs setting STAR targets. • During 1 yr observation period target setting was associated w/ 2,576 fewer residents at risk for PUs developing a PU • If STAR targets routinely utilized & level of improvement realized by all NH nationwide, an estimated 45,000 residents would have better PR & PU outcomes at end of 1 yr.

⁴⁵ Reddy M, et al. Preventing pressure ulcers: A systematic review. JAMA, 296:974–984, Aug. 23, 2006.

⁴⁶ Strategies for Preventing Pressure Ulcers. The Joint Commission Perspectives on Patient Safety. 2008 Jan, Vol 8, Issue 1.

⁴⁷ Lyder CH. Pressure ulcer prevention and management. JAMA 289:223–226, Jan. 8, 2003.

⁴⁸ Baier RR, et al. Aiming for star performance: the relationship between setting targets and improved nursing home quality of care. JAMDA 2008 Oct; 9(8):594-8.

Interventions Table: Pressure Ulcers

Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p style="text-align: center;">The National PU Long-Term Care Study</p>	<p>Bergstrom, et al. 2005⁴⁹</p> <p>Moderate - Retrospective study, secondary analysis</p>	<p>95 LTC facilities participating in the National Pressure Ulcer Long-Term Care Study (NPrULS) n=882 residents w/ length of stay 14 days or longer, w/1,589 PUs n=503 residents with only stage II n=234 residents with only stage III / IV</p> <p>Aim: Identify resident, wound, & treatment characteristics associated with PU healing in LTC res. Aim of Parent study (NPrULS): examine treatment factors influencing PU prevention & healing.⁵⁰</p> <p>Additional analysis re factors associated with PU development & prevention of PUs⁵¹</p>	<p>Data collected by multidisciplinary team for 12 wks (from MDS, medical record & other records) on:</p> <ul style="list-style-type: none"> • Resident characteristics • Treatment characteristics <ul style="list-style-type: none"> ➢ Pressure relieving surfaces ➢ Sufficient enteral feeding ➢ Interaction of sufficient enteral feeding & severity score ➢ Oral supplements ➢ Duration between assessments ➢ Debridement ➢ Dressings/wound treatments (Dry, moist, unknown, multiple) ➢ PU cleansers • Change in PU area 	<ul style="list-style-type: none"> • 37% of Stage II PUs healed & 5% of stage III & IV PUs healed • Residents w/ stage II older, but lower severity of illness scores than w/ III/IV • Stage II PU area was ↓ more with moist than dry dressings • PUs cleaned w/saline or soap showed less ↓ in area than PUs cleaned w/other cleansers (such as antiseptic, antibiotic, or commercial cleansers) • Change in area of Stage III & IV PUs related to sufficient enteral feeding, enteral feeding without higher acuity levels, size of PU & type of dressing • Stage III and IV PUs ↑ in area when debrided • In this sample of NH res, moist dressings (Stage II, Stage III and IV) & adequate nutritional support (Stage III and IV) are strong predictors of PU healing.
<p style="text-align: center;">Turning & Repositioning</p>	<p>Krapfl and Gray, 2008⁵²</p> <p>Moderate to Excellent – Literature review, cited by ³⁹</p>	<p>n=5 studies based on systematic review from Jan 1960-July 2008.</p> <p>Selection criteria included prospective RCTs or quasi-experimental studies:</p> <ul style="list-style-type: none"> • Comparing repositioning to any other preventative interventions or • Comparing techniques of repositioning such as turning frequency • Measuring PU incidence <p>Aim: Review evidence on efficacy of repositioning as a PU prevention intervention</p>	<p>Interventions included:</p> <p>Turning frequency:</p> <ul style="list-style-type: none"> • Comparing 2 hour repositioning to 4 hour repositioning • Comparing every 2, 3, 4 or 6 hours vs standard care in 30° lateral vs 30° semi-Fowler's position. Patients turned 2 & 3 hrs on standard mattress & turned 4 & 6 hrs on viscoelastic foam mattress <p>Various positions:</p> <ul style="list-style-type: none"> • Head elevated to 30° vs 90° lateral vs supine & frequency of turning (Reddie, et al. 2006) • 30° pelvic tilt vs 90° side-lying 	<ul style="list-style-type: none"> • Limited evidence suggests that repositioning every 4 hrs when combined w/ pressure redistribution surface, is just as effective for prevention of facility acquired PUs as more frequent (every 2 hr) regimen • Insufficient evidence to determine if 30° lateral position is superior to 90° lateral position or semi-Fowler's position

⁴⁹ Bergstrom N, et al. The National Pressure Ulcer Long-Term Care Study: Outcomes of Pressure Ulcer Treatments in Long-Term Care. J Am Geriatr Soc. 2005 Oct;53(10):1721-9.

⁵⁰ Horn SD, Bender SA, Bergstrom N et al. Description of the National Pressure Ulcer Long-Term Care Study (NPrULS). J Am Geriatr Soc 2002;50:1-10.

⁵¹ Horn SD, et al. The National Pressure Ulcer Long-Term Care Study: Pressure Ulcer Development in Long-Term Care Residents. J Am Geriatr Soc. 2004 Mar;52(3):359-67.

⁵² Krapfl LA and Gray M. Does regular repositioning prevent pressure ulcers? J Wound Ostomy Continence Nurs. 2008 Nov-Dec;35(6):571-7.

Interventions Table: Pressure Ulcers

Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
<p style="text-align: center;">Turning & Repositioning (continued)</p>	<p>Moore & Cowman, 2009⁵³</p> <p>Moderate – Discussion of literature review, no RCTs or evidence-base</p>	<p>Selection criteria included RCTs or Clinical Control Trials (CCTs):</p> <ul style="list-style-type: none"> • Comparing repositioning w/ no repositioning • Comparing different repositioning techniques • Comparing different repositioning frequencies <p>Aim: Assess the effects of repositioning patients on the healing rates of PUs</p>	<p>Systematic review of all databases through November 2008 searching for RCTs or CCTs</p> <ul style="list-style-type: none"> • No studies met inclusion criteria 	<ul style="list-style-type: none"> • Despite widespread use of repositioning to manage PUs, no RCTs exist to assess the effects of repositioning patients on PU healing • Cannot conclude that repositioning ↑ PU healing rates <p>Discussion re repositioning not related to RCTs:</p> <ul style="list-style-type: none"> • In order to maintain health, tissues require adequate supply of oxygen & nutrients (Gottrup, 2004) • Pressure from lying or sitting on particular part of body results in oxygen deprivation (Defloor, 2005) • Failure to reposition will result in ongoing oxygen deprivation & tissue damage (DeFloor, 2005) & ongoing occlusion of blood supply (Husain, 1953). • Repositioning advocated as intervention for PU mgmt (Krapfl, 2008) • Patients unable to reposition require assistance (AHCPR 1992; EPUAP 1998; NICE 2005)

⁵³ Moore ZEH and Cowman S. Repositioning for treating pressure ulcers. Cochrane Database Syst Rev. 2009 Apr 15;(2):CD006898.

Interventions Table: Pressure Ulcers

Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Wound Care	<p>AHRQ/Horn, 2009⁵⁴</p> <p>Moderate to Excellent – Literature review, note link w/citation below</p>	<p>Summary of 12 studies re wound debridement (from total of 78 studies reviewed) including:</p> <ul style="list-style-type: none"> • Citation • Setting • Sample • Design • Results & conclusions <p>Aim: Review of literature to summarize existing evidence about treatments to ↑ PU healing.</p>	<p>Intervention topics assessed include:</p> <ul style="list-style-type: none"> • Nutrition • Support surfaces • Wound debridement • Skin cleansers • Hydrocolloids/wound dressings • Other adjunctive therapies • Topical agents, growth factors & skin equivalents • Bacterial control • Vacuum assisted closure • Negative Pressure Wound Therapy (NPWT) 	<p>Wound Debridement Results & Conclusions:</p> <p>Colleganase:</p> <ul style="list-style-type: none"> • Collegenase was more effective in debridement than control treatment (Boxer, et al 1969) • Significant ↓ in PU healing time, odor, inflammation, ↓ necrotic tissue & ↑ granulation tissue w/ collagenase (Rao, et al 1975) <p>Debrisan</p> <ul style="list-style-type: none"> • Less time to debridement in Debrisan-treated ulcers than other ulcers (Shand & McClermont, 1979) <p>Maggot therapy</p> <ul style="list-style-type: none"> • In 3 weeks, maggot-treated wounds contained 1/3 less necrotic tissue & twice granulation tissue as control; more effective and efficient in debriding chronic PUs than conventional treatment; readily accepted by patients; adverse events uncommon. (Sherman, 2002) • Better outcomes w/free-range vs contained technique (Steenvoorde, 2005) <p>Nonwoven sponges</p> <ul style="list-style-type: none"> • Open mesh 100% cotton nonwoven sponges are effective in debriding nonviable tissue • 8x8 mesh more effective than other nonwoven sponges (Mulder, 1995) <p>Water Jet</p> <ul style="list-style-type: none"> • Water jet group significantly fewer procedures than conventional group • \$1,900 cost savings/pt with water jet (Granick, 2006) <p>Zinc Oxide compared to Varidase</p> <p>Zinc oxide & Varidase regimens are about equally effective in the treatment of necrotic tissue (Agren, et al. 1985)</p>

⁵⁴ Horn SD. *On-Time Pressure Ulcer Healing Project: Literature Review*. July 2009. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/research/pressureulcerhealing/pruhl.htm>.

Interventions Table: Pressure Ulcers

Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Wound Care (continued)	AHRQ/Horn, 2009 ⁵⁵ Moderate to Excellent – Literature review, note link w/citation below	Summary of 23 studies re hydrocolloids/wound dressings (from total of 78 studies reviewed) including: <ul style="list-style-type: none"> • Citation • Setting • Sample • Design • Results & conclusions <p>Aim: Review of literature to summarize existing evidence about treatments to ↑ PU healing.</p>	Intervention topics assessed include: <ul style="list-style-type: none"> • Nutrition • Support surfaces • Wound debridement • Skin cleansers • Hydrocolloids/wound dressings • Other adjunctive therapies • Topical agents, growth factors & skin equivalents • Bacterial control • Vacuum assisted closure • Negative Pressure Wound Therapy (NPWT) 	Hydrocolloid/wound dressing significant findings: <ul style="list-style-type: none"> • Treatment w/calcium alginate 1st & then hydrocolloid dressing promotes faster healing than treatment w/ hydrocolloid dressings alone (Belman, et al 2002) • Collagenase treatment more cost effective than hydrocolloid in patients w/stage IV PUs on heel; also ↓ wound healing time (Muller, et al 2001) • Hydrocolloid dressings ↑ PU healing rate compared to wet-to-dry dressings (Gorse, et al 1997) • Protocol of inexpensive moist wound treatments completely healed most PUs, low cost (Frantz, 2001) • Polyvinylidene film dressing more effective than conventional treatment w/severe PUs (Takahashi, 2006) • Wounds w/radiant heat dressing healed significantly faster than standard care (Kloth, et al 2000)
	AHRQ/Horn, 2009 ⁵⁶ Moderate to Excellent – Literature review, note link w/citation below	Summary of 3 studies re Negative Pressure Wound Therapy (NPWT) (78 studies reviewed) including: <ul style="list-style-type: none"> • Citation • Setting • Sample • Design • Results & conclusions <p>Aim: Review of literature to summarize existing evidence about treatments to ↑ PU healing.</p>	Intervention topics assessed include: <ul style="list-style-type: none"> • Nutrition • Support surfaces • Wound debridement • Skin cleansers • Hydrocolloids/wound dressings • Other adjunctive therapies • Topical agents, growth factors & skin equivalents • Bacterial control • Vacuum assisted closure • NPWT 	NPWT Significant Results & Conclusions: Philbeck, et al 1999 <ul style="list-style-type: none"> • The 97-day period of healing time expected of NPWT is 61% faster than the 247-day expected healing time for treating similar wounds w/ saline-soaked gauze • NPWT more cost effective. PUs treated w/NPWT for 97 days would cost \$14,546 while PUs treated with saline-soaked gauze would cost \$23,465. <p>Schwein, 2005: Patients receiving NPWT had statistically lower rates of hospitalization than comparison group Tachi, et al 2004: Topical negative pressure without dressing is an extremely effective treatment of PUs complicated by undermining</p>

⁵⁵ Horn SD. *On-Time Pressure Ulcer Healing Project: Literature Review*. July 2009. Agency for Healthcare Research and Quality, Rockville, MD.

<http://www.ahrq.gov/research/pressureulcerhealing/pruhlit.htm>.

⁵⁶ SD Horn. *On-Time Pressure Ulcer Healing Project: Literature Review*. July 2009. Agency for Healthcare Research and Quality, Rockville, MD.

<http://www.ahrq.gov/research/pressureulcerhealing/pruhlit.htm>.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Wound Care (continued)	Chan, et al. 2007 ⁵⁷ Moderate to Excellent – Literature review	42 references in article, unknown # meeting criteria of: Original & review articles of maggot debridement therapy. Aim: Review the current evidence on the mechanism of actions & clinical applications of maggot debridement therapy.	Literature search of PubMed & MEDLINE through January 2007: <ul style="list-style-type: none"> • Historical perspective • Larvae • Mechanism of debridement • Indications for treatment • Contra-indications & side-effects • Cost effectiveness • New delivery system (larval secretions delivered from a prototype hydrogel wound dressing vs live maggots) 	<ul style="list-style-type: none"> • Maggot therapy shown to be effective due to debridement, disinfection, & wound healing enhancement actions of maggot excretions/secretions. • The efficacy of maggot debridement demonstrated in chronic venous ulcers, PUs & diabetic ulcers. • New delivery system for the excretions/secretions shown to be as effective as using live maggots. • With proper sterilization & refinement of delivery techniques, maggot therapy safe & effective method of debridement for a variety of difficult-to-treat wounds.
	Gregor, et al. 2008 ⁵⁸ Moderate to Excellent – Systematic review	17 RCTs & non-RCTs comparing Negative Pressure Wound Therapy (NPWT) & conventional therapy for acute or chronic wounds Aim: Compare clinical effectiveness & safety of NPWT with conventional wound therapy	Systematic review of 4 online databases comparing NPWT & conventional therapy for acute or chronic wounds	Some indication that NPWT may improve wound healing, the body of evidence available is insufficient to clearly prove an additional clinical benefit of NPWT. The large number of prematurely terminated and unpublished trials is reason for concern.
	Heyneman, et al. 2008 ⁵⁹ Moderate to Excellent – Systematic review	29 publications w/28 studies Includes: RCTs or systematic reviews on treatment of PUs w/ hydrocolloids Aim: Describe current evidence in PU treatment w/hydrocolloids & give recommendations for clinical practice & further research. 3 outcome measures for PU healing: 1. # of healed wounds 2. Time to heal & 3. ↓ in wound dimensions. 5 outcome measures for dressings: 1. Ease of application & removal 2. Time needed for dressing changes 3. Dressing -absorption capacity 4. Pain during dressing changes 5. Side-effects	Systematic review of four databases through January 2007 identifying RCTs w/ hydrocolloids compared to: <ul style="list-style-type: none"> • Saline gauze • Foam dressings • Hydrocolloids • Hydrogels • Less-contact layers • Topical enzymes • Povidine gauze • Phenytoin • Biosynthetics • Radiant heat therapy Additionally: <ul style="list-style-type: none"> • Sequential use of hydrocolloids & alginates • Radiant heat therapy 	<ul style="list-style-type: none"> • Hydrocolloids most frequently used on stage II & III PUs. • Hydrocolloids more effective than gauze dressings to ↓ wound dimensions & in # of healed wounds • Absorption capacity, time needed for dressing changes, pain w/ dressing changes & side-effects were significantly in favor of hydrocolloids vs gauze dressings. • Compared w/ an alginate dressing, a polyurethane foam dressing, a less-contact layer, a topical enzyme & a biosynthetic dressing, hydrocolloids are significantly less effective. • Hydrocolloids less expensive than collagen-, saline- & povidine-soaked gauze but more expensive than hydrogel, polyurethane foam & collagenase.

⁵⁷ Chan DCW, et al. Maggot debridement therapy in chronic wound care. Hong Kong Med J. 2007 Oct;13(5):382-6.

⁵⁸ Gregor S, et al. Negative pressure wound therapy: a vacuum of evidence? Arch Surg. 2008 Feb;143(2):189-96

⁵⁹ Heyneman A, et al. A systematic review of the use of hydrocolloids in the treatment of pressure ulcers. J Clin Nurs. 2008 May;17(9):1164-73.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
Wound Care (continued)	Kordestani, et al. 2008 ⁶⁰ Excellent – RCT	n=54 patients w/ diabetic foot ulcers, PUs or leg ulcers randomly assigned to: <ul style="list-style-type: none"> • intervention (n=32 patients, 34 wounds) • control (n=22 patients, 26 wounds) Aim: Compare wound healing rate & incidence of infection in wounds treated w/bioactive dressing or conservative treatment (gauze)	Treatment for 21 days with either: <ul style="list-style-type: none"> • Intervention group: bioactive study dressing (containing hydrophilic mucopolysaccharide, chitosan) • Control group: gauze dressing Wound size, stage where appropriate & presence of infection were recorded at each dressing change & at 3 month follow up	<ul style="list-style-type: none"> • Control group: 4/26 PUs healed but remaining PUs deteriorated & became infected • Treatment group: 29/34 wounds healed completely, & none became infected; the 5 remaining wounds healed during follow-up period • Moist bioactive wound dressing significantly ↑ healing rate compared w/traditional dressings & can bring significant cost savings
	Moore and Cowman, 2008 ⁶¹ Moderate to Excellent - Systematic review of 3 RCTs	3 RCTs from systematic review Inclusion criteria - RCTs comparing: <ul style="list-style-type: none"> • Cleansing equipment • Cleansing solutions • Cleansing techniques Aim: Explore effect of wound cleansing solutions & techniques on PU healing	Systematic review of Cochrane databases: 2 RCTs compared different cleansing solutions: <ul style="list-style-type: none"> • Saline spray with aloe vera, silver chloride, decyl glucoside compared to isotonic saline • Saline compared with tap water 1 RCT compared cleansing techniques of whirlpool 20 min/day vs. no whirlpool (both w/ saline gauze dressing)	<ul style="list-style-type: none"> • No studies compared cleansing with no cleansing. • Significant ↑ in healing w/wounds cleansed with saline spray containing Aloe vera, silver chloride and decyl glucoside (Vulnopur) compared with isotonic saline • No statistically significant change in healing was seen when water was compared with saline • No statistically significant change in healing for ulcers cleansed with, or without, a whirlpool
	Simon, et al. 2009 ⁶² Moderate to Excellent - Review	Review of current literature & studies (including RCT) on use of MedihoneyTM products Aim: Comment on the use of medical honey in wound care	MedihoneyTM: mixture of 2 honeys containing glucose oxidase & Leptospermum compounds which contribute to its antibacterial activity. <ul style="list-style-type: none"> • Hygroscopic: draws moisture out & dehydrates bacteria Types of wounds/treatments reviewed w/ use of medical honey: <ol style="list-style-type: none"> 1. Recalcitrant wounds 2. Protection of catheter entry sites 3. Prevention of oral mucositis & gingivitis w/ cancer patients 4. Treatment of viral disease 5. Chronic ocular surface diseases 6. Lower extremity ulcers 	Evidence confirms antibacterial properties & additional benefits of medical honey on wound healing & should encourage use as alternative treatment approach Medical Honey Practical Advances: <ul style="list-style-type: none"> • Dressings - easily changed w/out pain or harm to regenerating tissue. • Malodor from recalcitrant wounds successfully abandoned w/medical honey due to antibacterial, anti-inflammatory & debriding effects. • Used w/all different stages of wound healing, in different types of wounds & w/ diabetic patients • Accepted by most patients & families

⁶⁰ Kordestani S, et al. A randomised controlled trial on the effectiveness of an advanced wound dressing used in Iran. Journal of Wound Care, Vol. 17, Iss. 7, 01 Jul 2008, pp 323 – 327.

⁶¹ Moore Z and Cowman S. A systematic review of wound cleansing for pressure ulcers. J Clin Nurs. 2008 Aug;17(15):1963-72.

⁶² Simon A, et al. Medical Honey for Wound Care—Still the ‘Latest Resort’? Evid Based Complement Alternat Med. 2009 Jun;6(2):165-73. Epub 2008 Jan 7.

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Type of Intervention	Citation & Evidence Rating	Targeted Sample & Aim	Specific Interventions & Related Information	Outcomes/Findings
	Vu, et al. 2007 ⁶³ Moderate to Excellent - Pseudo-randomized pragmatic cluster trial	20-week follow-up of 342 uncomplicated leg and pressure ulcers in 176 residents in 44 high-care NH in Australia: <ul style="list-style-type: none"> • Intervention (21 NH, 180 wounds, 94 residents) • Control (23 NH, 162 wounds, 82 residents) Aim: Evaluate the cost-effectiveness of multidisciplinary wound care team in the NH setting.	Residents in the intervention arm received standardized treatment from a wound care team comprising of trained community pharmacists and nurses. Residents in the control arm received usual care.	<ul style="list-style-type: none"> • More wounds healed in intervention than control arm (61.7% versus 52.5%, p=0.07) • Chances of healing increased 73% for intervention wounds (95% CI= 20–150%, p=0.003). • Average treatment cost ~ one-third less for intervention than for control residents (p=0.006) • Most cost reduction from decreases in nursing time and waste disposal. Conclusions: Standardized treatment provided by a multidisciplinary wound care team saved costs and improved chronic wound healing in NH. Main source of saving was in cost of nursing time in applying traditional dressings and in the cost of their disposal
Wound Care (continued)	Yapucu Güneş & Eser, 2007 ⁶⁴ Excellent - Randomized parallel group evaluation, small sample Cited by Simon, 2009	n=27 patients w/ 68 stage II or III PUs randomized to: <ul style="list-style-type: none"> • Honey Dressings (n=15 patients, 25 PUs) or • Ethoxy-diaminoacridine plus nitrofurazone dressings (n=11 patients w/ 25 PUs) Primary outcome measure change in PUSH tool scores in groups at 5 weeks Aim: Compare effect of honey dressing vs an ethoxy-diaminoacridine + nitrofurazone dressing in patients w/ PUs as measured w/ acetate tracings & Pressure Ulcer Scale for Healing (PUSH) weekly for 5 wks.	Honey dressings: <ul style="list-style-type: none"> • Wound irrigated w/ 0.9% NaCl solution • Primary dressing -gauze impregnated w/ sterilized honey • Secondary: semipermeable adhesive dressing to prevent leakage of honey. Ethoxy-diaminoacridine + nitrofurazone dressings: <ul style="list-style-type: none"> • Wound cleaned with ethoxy-diaminoacridine (0.1%) solution • Nitrofurazone cream applied to wound • Covered w/ gauze dressing soaked w/ ethoxydiaminoacridine solution. • Secondary covering: semipermeable adhesive dressing Dressings changed daily or if contaminated	<ul style="list-style-type: none"> • By week 5, PUSH tool scores showed that healing w/ honey dressing approximately 4 times the rate of healing in the comparison group. • Conclusion: honey dressings are effective & practical for treating PUs

⁶³ Vu T, et al. Cost-effectiveness of multidisciplinary wound care in nursing homes: a pseudo-randomized pragmatic cluster trial. *Fam Pract.* 2007 Sep;24(4):372-9. Epub 2007 Jun 29.

⁶⁴ Yapucu Güneş U and Eser I. Effectiveness of a honey dressing for healing pressure ulcers. *J Wound Ostomy Continence Nurs.* 2007 Mar-Apr;34(2):184-90.