Definitions and Levels or Strength of Evidence Ratings

AHRQ (Formerly AHCPR) Pressure Ulcer Treatment Guidelines (adapted to include diagnosis and risk assessment)

A. Results of a meta-analysis or two or more pressure (PU)-related randomized controlled trials (RCT) on humans provide support (or for diagnostics or risk assessment: prospective cohort (CO) studies and/or controlled studies reporting diagnostic or predictive validity measures.)
B. Results of one PU-related RCT in humans plus two or more similar Historically Controlled Trials (HCT) or Convenience Controlled Trials (CCT) or one HCT and one CCT provide support or when appropriate, results of two or more RCT in animal model validated as clinically relevant to PU provide indirect support.
C. This rating requires one or more of the following:

- C1: Results of one controlled trial, e.g. RCT, CCT or HCT (or for diagnostics or risk prediction one prospective CO study may be substituted for a controlled trial)
- C2: Results of at least two case series (CS) or descriptive studies or a cohort study in humans
- C3: Expert opinion (EO)

Definitions/Abbreviations Used in Evidence Table Below and in Pressure Ulcer Outline with Evidence and Content Validity:

Underlined references include cost analysis.

AFB = Air fluidized bed
AFT = Air floatation bed
AP = Alternating pressure mattress or overlay or cushion
AM = Animal Model
CC = Case Controlled Epidemiology Study
CCT = Convenience Assignment or Non-randomized Controlled Trial
CO = Cohort study *e.g.* of all consecutive patients admitted to a facility studied prospectively
CS = Case series or descriptive uncontrolled study of performance of one modality
CVI = Chronic Venous Insufficiency
EO = Expert opinion, Content Validation Study or Consensus Statement
ES = Electrical stimulation therapy
EM = Electromagnetic therapy
HCD = Hydrocolloid dressing
HCT = Historically Controlled Trial with successive measure on a series of patients
HF = Hydrofiber® dressing
HSF = High specification foam support surface
LAL = Low air loss support surface
LR: n = Literature Review including Systematic Reviews: number of studies supporting the modality
MA = Meta-analysis: number of patients with data supporting the modality added if known
NPWT = Negative pressure wound therapy
PCT = Within-patient Controlled Trial
PU = Pressure Ulcer(s)
RCO = Randomly selected patients from a cohort of patients
RCT = Randomized Controlled Trial: RCT = Human, ARCT = Animal
RET= Retrospective Chart Review
VF = Viscous Fluid support surface: bed or cushion

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
AHCPR Panel for the Prediction And Prevention Of Pressure Ulcers In Adults. Pressure ulcers in adults: Prediction and prevention. *Clinical Practice Guideline, No. 3.* Rockville, MD: U.S. Department of Health and Human Services. Public Health Service, Agency for Health Care Policy and Research. May, 1992. AHCPR Publication No. 92-0047.	First PU Guideline developed by AHCPR	Best level of evidence for most pressure ulcer prevention recommendations covered in the AAWC initiative to develop a comprehensive guideline of all diagnosis, prevention and treatment recommendations in all PU guidelines based on best available evidence.	Most PU prevention recommendations were based on expert opinion. A Level for Education at all levels to assess and alleviate causative factors; B-Level evidence supported repositioning, avoiding massage over sites at risk and using pressure reducing surfaces for at-risk patients.
Allman RM, Goode PS, Patrick MM, Burst N, Bartolucci AA. Pressure ulcer risk factors among hospitalized patients with activity limitation. JAMA. 1995 Mar 15;273(11):865-70.	286 patients admitted to tertiary care urban hospital in last 3 days expected to be confined to bed and >55 years of age, all without a Stage 2 PU	Outcome:time in hospital to develop a Stage 2 PU and risk factors were calculated using univariate Kaplan-Meier survival analyses (P < .05 by log-rank test).	Total cumulativePU incidence was 12.9% (n = 37) after a median time of 9 days from admission to final skin examination. Risk factors (p<0.05) for PU development were age 75 years or more, dry skin, nonblanchable erythema (a stage 1 pressure ulcer), previous PU hhistory, immobility,fecal incontinence, depleted triceps skinfold, lymphopenia (lymphocyte count < 1.50 x 10(9)/L), and decreased body weight (< 58 kg)
Allman RM, Walker JM, Hart MK, et al. Air-.fluidized beds or conventional therapy for pressure sores: a randomized trial. Ann Intern Med 1987; 107: 641–8.	65 hospitalized patients with at least one PU randomized to either Clinitron® repositoined every 4 h (n=31) or alternating air mattress covered by a foam pad (Lapidus Air Float System® on a standard hospital bed, n=34; repositioned every 2 h.	Prospective RCToutcomes reported blinded to treatment group were decrease in PU surface area and PU improvement in based on serial color photographs taken by investigators blinded to treatment group.	After adjusting for other factors associated with PU outcomes, estimated relative odds of a PU improving with air fluidized bed were 5.6 fold (p = 0.01) greater than control. Median area reduction and assessed improvement were greater for air fluidized bed group (p= 0.01). The effect was more pronounced for larger PU.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Alvarez OM, Kalinski C, Nusbaum J, Luz Hernandez L, Pappous E, Kyriannis C, Parker R, Chrzanowski G, Comfort CP, Incorporating wound healing strategies to improve palliation (symptom management) in patients with chronic wounds. J Palliative Medicine, 2007 Oct;10(5) : 1161-89.	Consider S-P-E-C-I-A-L (below) for PU in palliative care : S-stabilizing wound, P-prevent new wounds, E-eliminate odor,C-control pain, I- infection prophylaxis, A-advanced, absorbent wound dressings, L-lessen dressing changes.	LR Level C3--EO	Using wound palliation (symptom management) with current wound healing practices can provide appropriate options for palliative care providers.
Alvarez OM, Fernandez-Obregon A, Rogers RS, Bergman L, Black M. A prospective, randomized comparative study of collagenase and papain-urea for pressure ulcer debridement. *Wounds*. 2002;14(8):293–301.	After 1-2 week screening, stabilizing period: Collagenase (Santyl) ointmen: (26), mean age 76 years vs papain-urea chlorophyllin (26; Accuzyme®). Both treated 1-2 times daily	Prospective 4-week RCT on adults (mean age 74 years) with PT or FT PU measuring reduction of nonviable tissue and degree of granulation.	Wounds debrided with papain-urea experienced more rapid granulation and more removal of wound bed necrotic tissue at 4 weeks in PU with conservative debridement. There was no significant difference between groups in wound healing.
American Diabetes Association's New Clinical Practice Recommendations Promote A1C as Diagnostic Test for Diabetes, Dec 29, 2009; Alexandria, VA, USA www.diabetes.org, accessed January 17, 2010.	Guideline for Hb A1C updated annually to be published in January 2010 *Diabetes Care*	New recommendations, are revised every year to reflect the most current available scientific research	An A1C of 5.7 – 6.4 percent indicates that blood glucose levels are in prediabetic range, Diabetes. would occur once levels rose to an A1C of 6.5 percent or higher
Anthony D, Reynolds T, Russell L. regression analysis of the Waterlow score in pressure ulcer risk assessment. Clin Rehabil. 2003 ;17(2):216-23.	All admissions over a 5-year period in a UK general hospital. 43,735 records of patients with 954 having at least 1 PU	Cohort study used logistic regression to measure predictive validity of Waterlow PU Scale with and without age and gender.	Increasing age predicted PU but gender did not, resulting in conclusion that removing gender may improve Waterlow scale.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Aronovitch S. Intraoperatively acquired pressure ulcers: Are there common risk factors. OWM: 2007;53(2):57-69.	Literature review of factors associated with intraoperative PU development and prospective descriptive study of intraoperative PU development withing 96 h after surgery. 9 of the 252 study patients developed a PU (~3%). Of 9 who developed a PU, 8 received 3 or more anesthetic agents **in at least 2 of the categories**: inhalation, IV induction, muscle relaxant, hypnotic or opiod. 5 of the 9 patients who developed a PU needed mobility assistance and 5 had intact skin pre-peratively.	Descriptive review and prospective incidence study recording risk factors associated with intra-operative PU development. Retrospective review noted that intraoperative PU may result in a full-thickness necrosis 2-6 days post-op. They are exacerbated by peripheral vascular disease. 75% of patients were in **supine position,** and 4 of the 9 developing a total of 12 PU. **8 if 9 patients developing a PU were on a standard 2-inch foam pad OR mattress**. 3 patients developed a PU in sacracl/coccyx area, 2 had a heel ulcer, 3 had bilateral buttock PU.	PU caused during operative procedures often occur within 72 h after surgery and increase length of hospital stay by a mean of 3.5 - 10 days. Incidence varies from 12% to 66%. They may be unreported or unrecognized because patients are not considered at risk. Risk factors include **positioning** on bony prominences such as heels, sacrum and elbows, 63% of all receiving **2 or more categories of anesthetic agents**: sedatives or hypnotic agents,l ow serum albumin, low lymphocyte count, **cardiac disease**: hypotensive events during surgery, length of surgery, use of a heating device, extracorporeal or reduced circulation or adding a cloth or warming blanked over pressure-redistributing surfaces. **Orthopedic** surgeries had higher risk of PU.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Ayello E, Braden B. How and why to do pressure ulcer risk assessment. *Adv Skin Wound Care* 2002; 15(3):125-133.	Consistency of use and results of Braden Scale.	Literature review., excluding pre- and immediate post-operative use of Braden scale on healthy individuals due to low predictive validity for these individuals.	There is a need to clarify precise cut points, such as the proposed Braden Scale categories "At risk" = 15-18; "Moderate risk" = 13-14; "High risk" = 10-12; "Very high risk" = 9 or below.
Baba-Akbari Sari A, Flemming K, Cullum NA, Wollina U. Therapeutic Ultrasound for pressure ulcers. Cochrane Database Syst Rev, 2006 Jul 19;3CD001275.	3 trials involving 146 individuals; 2 RCT's with sham comparison & 1 with ultrasound/UV light vs laser vs standard care	LR of RCT's comparing therapeutic ultrasound with sham or standard treatment. MA was used to combine the results.	No statistically significant difference in ulcer healing occurred in any study. Further research is needed to substantiate beneficial or harmful effects on wound healing related to therapeutic ultrasound.
Bahrestani M. The lived experience of wives taking care of their frail elderly husbands with pressure ulcers. *Advances in Wound Care,* 1994; 7(3):40-2, 44, 46, 50, passim.	6 elderly wives caring for their frail, homebound husbands with pressure ulcers	Phenomenological study exploring major recurring themes of the lived experience of these individuals	Major themes**:** difficulty caregiving, caregiver frailty, limited socialization, limited social support systems and limited caregiver knowledge. Recurring minor themes were fear regarding future and symbolic meaning of the PU.
Baharestani MM, Houliston-Otto DB, Barnes S. Early versus late initiation of negative pressure wound therapy: examining the impact on home care length of stay. Ostomy Wound Manage. 2008;54(11):48-53.	98 patients with Stage III or IV PU and 464 surgical wound patients in the home care setting July 2002-September 2004	Retrospective non-randomized chart review of length of stay (LOS) in home care for patients receiving early (<30 days following admission) or late (>30 days) NPWT for their Stage III or IV PU.	Median LOS for early-NPWT PU patients was 85 d and 166 days for late-NPWT PU and 57 d for early- NPWT and 87 d for late-NPWT treated surgical patients . Controlling for patient variables, regression each day NPWT initiation was delayed added 0.96 day to PU group stay (p<0.0001)

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Baranoski S, Ayello E. *Wound Care Essentials: Practice Principles.* Ch. 10. Posthauer ME, Thomas DR.. Nutrition and Wound Care. 2004: pp 157-186.	Summary tables of nutritional markers linked to PU and normal values	LR of mainly CO studies with markers associated with presence of a PU and those not associated with PU	Albumin (7 CO), BMI (1 CO), total lymphocyte count (TLC: 1 CO), severe malnutrition (1 CO) feeding dependency (1 CO), cholesterol (1 CO), hemoglobin (1 CO), low protein or iron intake (1 CO)
Barr JE, Day AL, Weaver VA, Taler GM. Assessing clinical efficacy of a hydrocolloid/alginate dressing on full-thickness pressure ulcers.	Patients with Stage III or IV PU from 3 acute care hospitals (22) with no initial surgical debridement; 1 LTC facility (8) with wide surgical debridement started with no necrotic tissue/eschar/slough.	All patients had autolytic debridement with a hydrocolloid-alginate wound filler and a 2ndary hydrocolloid dressing $\leq$ 24 days. Measures: PU bed granulation, epithelization necrotic tissue, eschar or slough and PU area.	During a mean of 12.9 days surgically debrided PU decreased more in area than autolytically debrided (p=.03). Autolytically debrided PU decreased in nonviable tissue and increased in granulation and epithelization (p=0.03). Surgically debrided did not.
Barone, M ede The Harriott Lane Handbook. 14th ed. St Lois, Mo: Mosby 1996 115-123	Pediatric albumin from Yale hospital system	Textbook References for pediatric nutrition: total protein, albumin and prealbumin	In order total protein, albumin, prealbumin Newborn: 4.4-7.6 , 3.2-4.8, 4-36 mg/dl 1-3 mos. 3.6-.4 2.1-4.8 13-27 3-12 mos. 4.2-7.5 2.8-5.7 1-12 years 3.7-7.9 3-2-5.1 12-28
Bates Jensen BM, The Pressure Sore Status Tool a few thousand assessments later. *Adv Skin Wound Care*, 1997 ;10(5) :65-73.	9 member Delphi panel content validated tool; ET nurses tested reliability in acute care and 1 ET plus 15 regular practitioners in long term care	Review of 2 prospective cohort studies. Intra-rater and inter-rater reliability was tested on 16 wounds rated 2 hours apart. Delphi panel generated Content validity index	Mean overall content validity index was 0.91. Mean ET nurse inter-rater reliability was 0.915; intra-rater 0.975. Regular practitioners inter-rater reliability 2 h apart was 0.78 in long term care with intra-rater reliability of 0.89
Belmin J, Meaume S, Rabus MT, Bohbot S; Investigators of the Sequential Treatment of the Elderly with Pressure Sores (STEPS) Trial. Sequential treatment with calcium alginate dressings and hydrocolloid dressings accelerates pressure ulcer healing in older subjects: a multicenter randomized trial of sequential versus nonsequential treatment with hydrocolloid dressings alone. J Am Geriatr Soc. 2002;50(2):269-74.	Sequential alginate for first 4 weeks then 2nd 4 weeks of hydrocolloid dressings (57 elderly patients with Stage III or IV PU) Hydrocolloid dressing continuously for 8 weeks (53 similar patients)	Prospective 8-week RCT in a French university hospital, measuring absolute surface area reduction (SAR) and number of patients achieving at least 40% SAR during the 8-week study period.	More in sequential group achieved SAR40 at 4 weeks and 8 weeks and there were significantly larger SAR reductions at 4 and 8 weeks in the sequential group than in the hydrocolloid-only group. Dressings in both groups were well tolerated.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Bergstrom N, Bennett MA, Carlson CE et al. *Treatment of Pressure Ulcers.* Clinical Practice Guideline, No. 15. Rockville, MD: U.S. Department of Health and Human Services. Public Health Service, Agency for Health Care Policy and Research. December, 1994. AHCPR Publication No. 95-0652.	Guideline developed by AHCPR	Best level of evidence for most pressure ulcer treatment recommendations covered in the AAWC initiative to develop a comprehensive guideline of all diagnosis, prevention and treatment recommendations in all PU guidelines based on best available evidence.	Most treatment recommendations were based on expert opinion. A Level included: 2 week systemic antibiotics for systemic infections or topical antibiotics for non-healing PU; assess, educate and continue preventive measures to prevent PU recurrence. B-Level included avoiding topical antiseptics, appropriate nutrition; static pressure relief for mobile or dynamic for non-mobile patients, using safe, electrical stimulation, cleansers at 4-15 psi and dressings that keep the PU continuously moist.
Bergstrom N, Braden B. A prospective study of pressure sore risk among institutionalized elderly. *J Am Geriatr Soc* 1992; 40:747-758.	200 newly-admited residents >65 years of age and Braden Scale $\leq$ 17 with no PU in a 250-bed skilled nursing facility with 90 extended care beds	Prospective cohort study used logistic regression to identify best predictors of PU development assessed with aids (braces, stockings etc) removed after Braden Scale measure on admission, then weekly for 4 weeks, then biweekly for 8 wks	Best predictors of PU development were Braden Scale $\leq$ 17 , low diastolic blood pressure, elevated temperature and lower than normal daily caloric protein intake or serum albumin.
Bergstrom N, Braden B, Kemp M, Champagne M, Ruby E. Predicting pressure ulcer risk: a multisite study of the predictive validity of the Braden Scale. *Nurs Res.* 1998;47(5):261-269.	843 total patients including: 306 in tertiary care, 282 in VA medical centers, 255 in nursing homes.	Prospective cohort study observed presence or absence of a PU associated with patient demographic variables and Braden Scale risk assessment.	Lower Braden Scale, older age and white race are significant predictors of developing a PU
Bergstrom N, Braden BJ. Predictive validity of the Braden Scale among black and white subjects. Nurs Res. 2002;51(6):398-403.	843 clients (666 or 79% white, 159 or 12% black) from nursing homes, tertiary care and VAMCs in Omaha, Chicago & Raleigh	Randomly selected subjects rated on Braden Scale & Skin Assessment Tool every other day. Measured incidence of PU and validity of Braden	Higher incidence of new PU for whites (15%) than blacks (5%) Blacks were similar to whites on Braden Scale. 18 cutoff yielded best sensitivity, specificity & % correct (all in 70% ranges; ROC diff=.005) predictions for both groups

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Bergstrom N, Horn SD, Smout RJ, Bender SA, Ferguson ML, Taler G, Sauer AC, Sharkey SS, Voss AC. The National Pressure Ulcer Long-Term Care Study: outcomes of pressure ulcer treatments in long-term care. J Am Geriatr Soc. 2005;53(10):1721-9.	882 residents ≥18 y of age of 95 US long term care facilities with length of stay at least 14 days who had at least 1 Stage II-IV PU	Retrospective convenience sampled cohort study. Data from Minimum data set over 12 week period for each resident were: treatment, PU change in area and characteristics. Two multiple regression analyses to determine treatment effects on Stage II and on Stage III –IV	Stage II reduced more in area with moist than dry dressings (p<0.001) All PU decreased more in area if cleansed with if cleansed with antiseptic or antibiotic than if cleansed with soap or saline. Change in Stage III-IV PU area was related to sufficient enteral feeding, enteral feeding without higher acuity levels, PU size, moist and dry dressing. Stage III-IV increased in area when debrided.
Bergstrom N, Braden B, Kemp M, Champagne M, Ruby E. Multi-site study of incidence of pressure ulcers and the relationship between risk level, demographic characteristics, diagnoses, and prescription of preventive interventions. J Am Geriatr Soc. 1996;44(1):22-30.	**843 randomly selected patients from 2 SNFs who were over 19 years of age who** did not have pressure ulcers on admission to their place of care	Observed every 48-72 hours for at least 4 weeks after enrollment	**Logistic regression demonstrated that lower Braden Scale scores, older age and white race predicted pressure ulcers; gender was not** predictive.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Berlowitz, DR, Brandeis GH, Anderson J, Du W, Brand, H. Effect of pressure ulcers on the survival of long-term care residents. J Gerontol, 1997 ; 52A (2) :M106-M110.	19981 patients in 5 VA Long-term care (LTC) centers.	Prospective cohort study exploring effect of a PU on survival of institutionalized LTC residents. Independent relative risk (RR) was calculated from a proportional hazards model of variables independently associated with dying during a 6 month follow-up period.	Having a PU was independently associated (p<0.05; RR=1.45) with dying. Other risk factors included terminal illness (RR=4.66), oxygen (2.76) or radiation (2.07) or dialysis (1.87) therapy blood transfusion (1.84) or male gender, residing on intermediate medical unit (1.34) or dehydration (1.32)
Berlowitz DR, Wilking SV. Risk factors for pressure sores. A comparison of cross-sectional and cohort-derived data. J Am Geriatr Soc. 1989;37(11):1043-50.	100 of 301 patients in a cohort admitted to a chronic care hospital over a 13-month period. Goal was to compare cross-sectional to cohort analysis. 185 had no PU on admission 20 of these developed a PU: used for PU prediction.	Cross-sectional compared patients with vs without a PU on admission. The cohort analysis compared patients on admission and after 3 weeks. Risk factors identified using univariate stepwise logistic regression	Factors associated (p<0.05) with PU presence were altered consciousness level (OR = 4.1), bed- or chair-bound (OR =2.4), impaired nutritional intake (OR = 1.9), hypoalbuminemia (OR = 1.8 for 10 mg/mL decrease). History of cerebrovascular accident (OR = 5.0), bed- or chair-bound (OR = 3.8), and impaired nutritional intake (OR = 2.8) predicted development of a new PU
BillTJ, Ratliff CR, Donovan AM, Knox LK, Morgan RF, Rodeheaver GT. Quantitative swab culture versus tissue biopsy: A comparison in chronic wounds. *Ostomy/Wound Management* 2001;*47:* 34-37.	38 patients with chronic wounds including some with a PU	Prospective correlational study between quantitative biopsy and swab culture.	28 (74%) of the 38 biopsies indicated infection. 22 or 79% of these also indicated infection on the swab culture. Authors concluded that swab culture is a valuable adjunct to managing chronic wounds.
Bluestein D, Javaheri A. Pressure ulcers: prevention, evaluation, and management. Am Fam Physician. 2008;78(10):1186-94.	Algorithm of pressure ulcer care for Family Physicians	Literature review and algorithm for PU management	Supports pressure relieving mattress better than standard mattress (Level A) surgical debridement except for stable heel ulcers. (Level C)
Bogie & Ho. Multidisciplinary approaches to the pressure ulcer problem. OWM.2007. Oct.53(10)26-32.	Improve care, and reduce PU occurrence through a team approach: illustrated with 3 teams: WHRU (Harding) PACWC (Jones) and Cleveland VAMC (Ho)	Literature review of PU outcomes using multidisciplinary team; pilot studies evaluating tele-health PU assessments and description of VA project using neuromuscular electrical stimulation to prevent PU	Multidisciplinary team Improved outcomes, cost savings and educational / research development. Telehealth PU assessments agreed with wound bed assessment (Kappa < 0.06) with low reliability on dimensions which remained inconsistent after training

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Bolton LL, van Rijswijk L, Shaffer FA. Quality wound care equals cost –effective wound care. *Nursing Management,* 1996; 27(7):30, 32-33,37.	Cost effectiveness calculated from published RCTs comparing hydrocolloid dressings with gauze.	Literature review including basic definitions of direct and indirect costs and cost effectiveness in wound care	Hydrocolloid protocols were more cost effective than gauze-based protocols of care in pressure ulcers, leg ulcers and burns.
Bolton LL. Evidence-based Report Card: Which pressure ulcer risk assessment scales are valid for use in the clinical setting? JWOCN 2007; 34(4):368-381.	Published references (n=70, > 3 randomized cohort studies) on more than 7000 patients in surgical, acute and chronic care, home and hospice settings addressing predictive validity of pressure ulcer risk assessment scales (PURAS). 15 studies assessed risk day of admission; 21 days 1-3, then weekly	Systematic review of validity and utility of pressure ulcer risk assessment scales (PURAS) across settings and professional PURAS users. PURAS scales are not validated for preoperative use in healthy individuals who may develop a PU while anesthetized lying on a hard surface (Level B)	Braden, then Norton, then Waterlow have highest predictive validity with all 3 being valid PU predictors (Level A cohort evidence) Braden and Norton are reliable when used by a professional nurse, ideally one who has directly cared for patient and should be administered to all patients on admission, though cut points for risk vary by setting. (Level B)
Bolton L, McNees P, van Rijswijk L et al. Wound healing outcomes using standardized care JWOCN 2004; 31(3):65-71	373 full-thickness (Stage III or IV) PU and 134 partial-thickness Stage II PU managed using content validated *Solutions*® protocol using best available evidence based principles of patient and wound care.	Prospective cohort study in 2 LTC, 1 LTAC and 12 home care agencies. The latter were managed by trained WOCNs connected via telemedicine to less trained care givers.	36% of 373 Stage III-IV PU healed in 12 weeks. 61% of 134 Stage II PU healed in 12 weeks using evidence based or content validated principles of pressure ulcer care and mainly hydrocolloid dressings to maintain a moist wound bed, plus alginate or Hydrofiber® dressings to manage excess exudate.
Bots TC, Apotheker BF. The prevention of heel pressure ulcers using a hydropolymer dressing in surgical patients. J Wound Care. 2004;13(9):375-8	Self-adhesive Tielle (140 ICU patients stratified by duration of operation and heel PU risk ;	Prospective open label application of foam dressing to heels of patients at risk (Norton Scale) of a PU compared to historic control data of heel PU incidence in similar patients. Measure was heel PU incidence by 10 days post operatively	Heel pressure ulcer development decreased 76.7% during the 4-month period of the study during foam dressing use. All 23 subjects whose surgery lasted < 90 minutes were dropped due to discharge with insufficient data. No adverse effects observed.
Boutin RD, Brossman J, Sartoris DJ, Reilly D, Resnik D. Update on Imaging of Orthopedic Infections. Orthopedic Clinics of North America. 1998; Vol 29(1);41-66.	Multifaceted review of bone & soft tissue infections inclusive of PU etiology with photo documentation of various imaging results	EO, case reports & LR	Condition specific recommendations for most useful imaging technique; accuracy of advanced imaging with CT, MRI, nuclear imaging explained in detail relative to patient morbidities

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Bouza C, Saz Z, Muñoz A, Amate JM. Efficacy of advanced dressings in the treatment of pressure ulcers: a systematic review. J Wound Care. 2005;14(5):193-9.	Hydrocolloid (239) or conventional (233) or other advanced dressings	Systematic review of wound dressings with published healing outcomes on pressure ulcers.	There was sufficient evidence to conclude that only HCD showed greater healing efficacy compared to conventional dressings.
Braden BJ, Bergstrom N. Predictive validity of the Braden Scale for pressure sore risk in a nursing home population. *Research in Nursing & Health* 1994; 17:459-470.	102 qualifying newly admitted nursing home residents without a PU, randomly selected mean age 75.9	Braden Scale PU Risk was assessed on admission (Time 1) 48-72 hours after admission (Time 2) +every 48-72 hours thereafter for 4 weeks. Predictive value of Braden Scale score was related to PU develop	Receiver operating curves showed 18 to be best cut-off for predicting PU, correctly classifying 64% of subjects at Time 1, 71% at Time 2 and 75% just before the first observation of a PU, which also had highest specificity and positive and negetive predictive values.
Brandeis GH, Berlowitz DR, Hossain M, Morris JN. Pressure ulcers: The Minimum Data Set and the Resident Assessment Protocol *Adv Wound Care* 1995; 8(6):18-25.	2011 Nursing Home residents aged 60 or older who lived in 270 facilities from 10 states and were evaluated as part of the Minimum Data Set (MDS) 1994	Cross-sectional cohort study of residents to determine incidence and prevalence of Stage II-IV PU and logistic regression analysis to determine PU risk factors.	Prevalence of PU in 11.2% of residents. None 82.7% Stage I-6.2%; II-7.7%; III-2.3%; IV-1.2%. 6-month incidence of new PU in residents initially with no PU was Stage I 4.7%, II-5.1%, III-0.7% Transfer or mobility dependence, being bedfast or having diabetes or past PU were associated with developing a Stage II-IV PU.
Brett DW. Impact on exudate management, maintenance of a moist wound environment, and prevention of infection. *J Wound Ostomy Continence Nurs*. 2006;33:59-64.	2 RCT comparing wear time of foam and hydrocolloid dressings on PU	Literature review	No significant difference in PU wear time between foam and hydrocolloid dressings.
Brienza D, Karg PE, Geyer MJ, Kelsey S, Trefler E. Using support surfaces to manage tissue integrity. *Advances in Skin and Wound Care*, April 2005, Vol 18 No. 3 151 - 157	Review of definitions, literature and expert opinion	Expert opinion and literature review on support surface categories.	Interface pressure is not an effective measure of the effectiveness of SS or category of devices. Incidence decrease is the best evidence of effectiveness (currently)

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Brienza DM, Karg PE, Geyer MJ, Kelsey S, Trefler E. The relationship between pressure ulcer incidence and buttock-seat cushion interface pressure in at-risk elderly wheelchair users. Arch Phys Med Rehabil 2001;82:529-33	32 Skilled Nursing Facility patients ≥ 65 years of age with no PU on enrollment and Braden movility and activity scores ≤5 who used a wheelchair ≥ 6 h per day. Half each given generic foam or pressure-reducing seat cushion	RCT of duration 1 to 12 months foam seat cushion use, measuring incidence of new PU and peak and average interface pressures between buttocks and wheelchair seat cushion on a 15 x 15 pressure sensor array.	Both peak pressure and average of 4 highest pressures among the sensor array were highest for patients developing sitting-acquired PU compared with those who did not in this elderly population.
Brink, Peter, M.A.,PhD, Trevor Fries Smith, PhD, Barbara Linkewich, RN, HBScN, IBCLC. Factors Associated with Pressure Ulcers in Palliative Home Care. J Palliative Medicine 2006, Vol 9, Number 6, 1369-1375.	Study included all 561 home care clients diagnosed with terminal cancer receiving palliative home care from one of Ontario's community care access centers. Health information was gathered March 2002 to Dec 2004 using the interRAI instrument for palliative home care.	Cohort study with the goal of identifying factors associated with PU development among home care clients whose prognosis exceeded 6 weeks.	Study found factors to be related to gender, inability to lie flat secondary to short-ness of breath, single position for comfort, catheter or ostomy care and poor ADLs. Symptoms contributing to developing a PU may be consequences of terminal illness and/or dying process. Important to address appropriate patient and caregiver goals.
Brown DL, Kasten SJ, Smith DJ Jr. Surgical Management of Pressure Sores. In: Krasner DL, Rodeheaver GT, Sibbald RG (eds): Chronic Wound Care: A Clinical Source Book for Healthcare Professionals, Fourth Edition, HMP Communications; 2007; 653-660.	Review	Surgical techniques and outcomes for managing PU. A table of operative planning is provided	Surgery generally improves PU closure rates: medically managed Stage 3 14% healed @ 6 weeks; surgical average healing time is 5 weeks post musculocutaneous flaps. Direct closure rarely works unless pressure cause is eliminated & wound is small.
Bryan CS, Dew CE, Reynolds KL.Bacteremia associated with decubitus ulcers. Arch Intern Med. 1983;143(11):2093-5.	104 episodes of bacteremia in 102 patients with a PU during 5 years in hospitals of 1 metropolitan US area.	Prospective Cohort study correlating "probable" origin of bacteremia from the PU	PU were probable source of bacteremia in 49% of episodes. Other infection sites documented in 86% of patients. Overall mortality was 55% with 51% of deaths attributed to infection.
Buntinx F, Beckers H, Briers A, Keyser AGD, Flour M, Nissen G, Raskin T, De Vet H. Inter-observer variation in the assessment of skin ulceration. *J Wound Care* 1996; 5(4):166-170.	3 physicians and 3 nurses rated 27 wounds (21 of them PU) on 20 patients on each of 5 assessment systems	Inter-observer correlations calculated for systems: (1) PU color (2) Shea PU Stage (3) PU size measured as longest length and longest width (4) PU area estimated from a grid divided into 5 mm squares (5) Clinical signs of infection.	Highest inter-observer agreements were for size and area. Next highest for clinical signs of infection, next lower for color. Shea PU Stage was lowest..

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Burgos, A. Giminez J, Moreno, E. Lamberto E, Utrera M, Urraca E.M., Velez J.J. Lopez, E. et al.. Cost efficacy, efficiency and tolerability of collagenase ointment versus hydrocolloid occlusive dressing in the treatment of pressure ulcers: A comparative randomised multicentre study. *Clinical Drug Invest,* 2000; 19(5):357-365.	Varihesive™ (DuoDERM® is US name) changed @ 3 days. For deep wounds Varihesive paste was also used (19) Iruxol Collagenase prescription ointment applied under gauze once daily in 1-2 mm thick layer to wound surface (Santyl® is US name) (18)	Prospective RCT of ulcer area, percent of wound covered with granulation tissue, exudate, odor, necrotic tissue removal and pain outcomes, reported at 1-week intervals as well as calculated cost effectiveness, and cost of care.	No statistically significant differences were seen in cost, efficacy or efficiency between collagenase ointment and hydrocolloid dressing. Tolerability was good and both regimens produced similar healing effects in patients with pressure ulcers
Burke DT, Ho CH, Saucier MA, Stewart G. Effects of hydrotherapy on pressure ulcer healing Am J Phys Med Rehabil. 1998;77(5):394-8.	Conservative treatment (CT-only) with wet-wet dressings using normal saline 2x/day (18 acute care patients with Stage III or IV PU) CT + Whirlpool 20 min/day (24 similar patients)	Prospective RCT followed at least 2 weeks. Physician blinded to treatment group measured each PU.	Conservative treatment + Whirlpool group improved at a significantly faster rate than the CT – only group. Note: Hydrotherapy replaces the "Whirlpool®" nomenclature
Cakmak SK, Gül U, Ozer S, Yiğit Z, Gönü M Risk factors for pressure ulcers. Adv Skin Wound Care. 2009;22(9):412-5.	32 immobilized patients with PU and 30 without a PU.	Prospective CCT correlating PU development with incontinence of stool or urine, smoking, alcohol use, diabetes, anemia or use of a PU reducing bed	Incontinence of stool and urine, smoking were associated (p<0.05) with PU development. PU developed faster in patients who had anemia or smoked (p<0.05)
Cereda E, Gini A, Pedrolli C, Vanotti A. Disease-Specific, Versus Standard, Nutritional Support for the Treatment of Pressure Ulcers in Institutionalized Older Adults: A Randomized Controlled Trial. J Am Geriatr Soc. 2009 57(8):1395-1402.	28 elderly residents in 4 long term care facilities. All had at least one Stage II, III or IV PU of < 1 month duration 13 control supplement 15 Added 400 ml oral or enteral supplement enriched with protein (20% of calories) arginine, zinc and vitamin C	Prospective RCT of 12-week duration. Measures were ulcer healing using PUSH (0 = complete healing; 17 = greatest severity) and mm^2 area and % reduction in area.	Groups were similar in age, gender, nutritional status, oral intake, type of feeding and ulcer severity. Both groups improved at 12 weeks (p<0.001) Enriched supplement group had higher PUSH score at week 12 (p<0.05) and more area reduction at week 8 (p<0.05) and 57% reduction area vs 33% (p<0.02). Faster healing with enriched formula.
Chaby et al. Dressings for acute and chronic wounds: a systematic review. Arch Dermatol.2007;143(10):1297-304.	Review of 89 RCT, 7 systemic reviews, 1 cost-effective study and 3 meta-analysis	Systematic review of all trials measuring effects of dressings on healing.	Weak levels of evidence were found for modern wound dressings compared to saline or paraffin gauze.

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Chacon JMF, Nagaoka C, Blanes L, Ferriera LM. Pressure ulcer risk factors among the elderly living in long-term institutions. Wounds, 2010; 22(4):106-113.	Cross section of 40 long-term care residents at least 60 years of age from 6 LTC centers in Sao Paolo, Brazil May-Aug 2007	Prospective analytic cross-sectional study of a cohort of LTC residents with vs without PU to identify risk factors. Fisher's exact test determined strength of association with PU	51 PU were recorded, most Stage 2 (42.5%) mainly in sacral area. Neurologic disorders was the only statistically significant predictor of PU development (p<0.05)
Chang KW, Alsagoff S, Ong KT, Sim PH. Pressure ulcers-randomised controlled trial comparing hydrocolloid and saline gauze dressing Med J Malaysia 1998; 53(4):428-31.	34 subjects ≥ 18 years of age with Stage II or III PU in a Kuala Lumpur hospital. Half randomized to saline gauze (SG), half to hydrocolloid dressings (HCD)	Prospective 643-day open label RCT measuring dressing performance, patient comfort and pain during dressing (DuoDERM CGF or saline gauze)removal, healing and cost of wound management.	The only significant results were better adherence to wound bed, exudate handling ability, overall patient comfort and pain during dressing removal for HCD than for SG. (P<0.001)
Cheney AM. Portrait of practice: a successful approach to preventing heel pressure ulcers after surgery. Decubitus. 1993;6(4):39-40.	30 patients undergoing total hip replacement	Cohort study measuring incidence of PU before and after adding heel protectors and pre- and post-operative patient education, elevating heels off all mattresses	No heel PU in 30 consecutive patients with education and heel protector interventions.
Cheneworth CC, Hagglund KH, Valmassoi B, Brannon C. Portrait of practice: healing heel ulcers. Adv Wound Care. 1994;7(2):44-8.	25 ICU patients at a community teaching hospital. 14 assigned at first sign of redness to foam boot, 11 to dressing foot wrap	CCT measuring incidence of heel PU improvement while wearing Lunax, BIO-SONICs boot or foot wrap	13 with foam boot improved. No subject with foot wrap improved.
Chernecky C, Berger B; Laboratory Tests Diagnostic Procedures,4th ed., 2004; Saunders, Philadelphia, PA	Medical textbook.	Screening and Diagnostic procedures and data	Adult & pediatric serum values of nutritional labs. ABI values for vascular study.
Chow AW, Galpin JE, Guze LB. Clindamycin for treatment of sepsis caused by decubitus ulcers. J Infect Dis. 1977;135 Suppl:S65-8.	24 patients with sepsis caused solely by a PU. 19 patients received appropriate systemic antibiotic	Prospective CCT measuring persistence of bacteremia in response to treatment with appropriate antibiotics (AA) with or without (SD)surgical debridement intervention	AA and SD: 14% mortality: AA, no SD: 67% mortality; Inappropriate antibiotic and no SD: 75% mortality

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Colwell, J., Foreman, M.D., Trotter, J.P.A Comparison of the efficacy and cost-effectiveness of two methods of managing pressure ulcers. *Decubitus* 1993;6(4):28 36.	DuoDERM CGF® Hydrocolloid Dressing (HCD: 33) vs Wet/wet saline gauze (SG: 37)	Prospective RCT of cost effectiveness (materials & labor) and healing of Stage II and III pressure ulcers, dressed for at least 8 days.	HCD-dressed ulcers contracted a mean of 0.73 cm^2 vs SG enlarging 0.67 cm^2. HCD cost less at $3.55/day vs SG $12.26/day. Limitation: more Stage III ulcers in gauze group.
Comfort T. Reducing pressure ulcer incidence through Braden Scale risk assessment and support surface use. *Advances in Skin and Wound Care, 2008;* 21:330-334.	Review of literature – Nine historically controlled prospective cohorts used Braden Scale to assess patient (n=876) risk of PU development to focus preventive care	Meta-analysis of 9 historically controlled trials that instituted Braden Scale guided PU prevention programs all measuring pre- and post-protocol incidence of PU	Lower PU incidence (p<0.05) for groups with a Braden-Scale-guided PU prevention protocol implementing low-air loss or fluidized bed therapy for high-risk patients. 95% confidence interval was 0.220-0.558 .
Compton F, Hoffman F, Hortig T, Strauss M, Frey J, Zidek W,Schafer J-H. Pressure ulcer predictors in ICU patients: Nursing skin assessment versus objective parameters *J Wound Care* 2008; 17(10):417-424	698 patients without a PU who had Waterlow PU risk score measured when admitted to ICU and planned to stay more than 72 h. Study conducted Apr 2001-Dec 2004 in Germany Acute Care settings. Results validated in 329 patients same setting Jan 2005-May 2006.	Literature review plus prospective CO study validity testing of parameters predicting PU development on the 121 (17%) of patients who developed a PU in the ICU. Multiple logistic regression (MLR) of Waterlow and subjective nursing skin assessment parameters.Validation study results were comparable to initial study. ICU mortality significantly correlated with PU development	84.6% correct PU prediction using Waterlow score on admission plus ICU stay duration, height, male gender, high temperature, high heart rate, parenteral feeding, sepsis, mechanical ventilation, vasopressor therapy, sedation, high blood glucose or insulin therapy, high Glasgow Coma Scale, invasive hemodynamic monitoring, skin condition on admission correlated p<0.001 with PU: erythema, moisture, edema, mottling, lividity, cyanosis, hyperemia and central line circulation.
Consortium for Spinal Cord Medicine (2000). *Pressure ulcer prevention and treatment following spinal cord injury: A clinical practice guideline for health-care professionals*. United States Government: Paralyzed Veterans of America.	Guidelines for prevention and treatment of PU in patients spinal cord injuries	Based on evidence when available, consensus when not available.	PU prevention and treatment recommendations for health-care professional use.

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Copeland-Fields LD, Hoshiko BR Clinical validation of Braden and Bergstrom's conceptual schema of pressure sore risk factors. Rehabil Nurs. 1989;14(5):257-60	A cohort of patients in a rehabilitation setting	Clinical validation retrospective cohort study using Fehring validation model to analyze relevance of 13 PU risk factors' validity in predicting PU	4 critical risk factors: low mobility, activity, sensory perception, and increased friction; 5 other risk factors: increased moisture, increased shear, decreased nutrition, decreased arteriolar pressure, and decreased interstitial fluid flow
Coutts P, Sibbald RG The effect of a silver-containing Hydrofiber dressing on superficial wound bed and bacterial balance of chronic wounds. Int Wound J. 2005;2(4):348-56.	30 participants, 4 with PU, with adequate vascular supply.	Prospective single-center open-label 4-week case series evaluating healing and maceration effects of a silver Hydrofiber® dressing on healing and maceration of superficial wounds that had stalled healing.	Most (70%) of wounds decreased in size, purulence, exudate and resolution of surface slough. Healthy granulation tissue increased and peri-wound maceration decreased. There was no burning or stinging on application.
Cullum N, McInnes E, Bell–Syer SEM, Legood R. Support surfaces for pressure ulcer prevention The Cochrane Database of Systematic Reviews 2004; 3.	Systematic Cochrane review >2 RCTs	Systematic literature review of trials measuring PU incidence and comparing support surface efficacy	Trained health care professionals should select pressure redistribution surfaces for beds, chairs and wheelchairs for at risk individuals.
Cullum N, Petherick E. Pressure ulcers. BMJ Clinical Evidence, Web publication date November 01,2006, at http://clinicalevidence.bmj.com/ceweb/conditions/ accessed February 1, 2008.	Systematic review includes 11 RCTs covering up to 682 pressure ulcer patients.	Systematic review of two systematic reviews, plus one additional RCT.	Reviewers found some limited evidence that HCD improved ulcer healing compared to gauze soaked in saline, hypochlorite, or povidone iodine for treatment durations up to 12 weeks.
Curley MA, Quigley SM, Lin M Pressure ulcers in pediatric intensive care: incidence and associated factors. Pediatr Crit Care Med. 2003 Jul;4(3):284-90.	322 patients, 21 days to 8 yrs of age, on bed rest in the PICU for at least 24 hrs without preexisting pressure ulcers or congenital heart disease	Multi-site prospective cohort study. Blinded to other's data, observers assessed skin and Braden Q up to three times a week for 2 wks, then weekly until PICU discharge (median 2 times)	86 patients developed 199 PU (70% Stage I, 27% Stg II; 3% Stg III. Sig. Predictors of a PU were low Braden Q, mechanical ventilation or hypotension.

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Day, A., Dombranski, B., Farkas, C., Foster, C., Godin, J., Moody, M., Morrison, M., Tamer, C. Managing sacral pressure ulcers with hydrocolloid dressings: Results of a controlled, clinical study. *Ostomy /Wound Manage-ment* 1995;41(2) :52-65.	Triangular-shaped Bordered DuoDERM CGF hydrocolloid dressing (52) vs Tegasorb® oval hydrocolloid dressing (51) Note: This is not the currently marketed form of Tegasorb®	Prospective randomized controlled study of wear time, healing and dressing performance on sacral pressure ulcers and dressing positioning for 6 dressing changes exploring differences between hydrocolloid dressings and effect of dressing position.	Greater rate and percent of ulcer healing, less pain and fewer adverse events with triangular-shaped than with oval hydrocolloid dressing. Hydrocolloid dressings can differ in performance characteristics. Triangle dressing wore longer with point downward.
Defloor T, De Bacquer D, Grypdonck MH. The effect of various combinations of turning and pressure reducing devices on the incidence of pressure ulcers. *Int J Nurs Stud*. 2005;42:37-46.	1. Turn q2h: standard hospital mattress (65) 2. Turn q3h :standard hospital mattress (65) 3. Turn q4h visco-elastic (VE) foam mattress (67) 4. Turn q6h on VE foam mattress (65) 5. Standard care per clinical judgment (576)	Prospective RCT completed by 761 patients at high risk of developing a PU	No significant difference in incidence of Stage I between groups, The incidence of Stage II – IV was significantly lower in the group turned every 4 hours on VE than the other groups (3.0% vs 14.3-24.1%)
Defloor T, Grypdonck MH. Do pressure relief cushions really relieve pressure? West J Nurs Res. 2000;22(3):335-50.	20 healthy volunteers Seated with knees bent at 90 degrees feet on floor. 29 cushions tested	Pressure reduction capacity of each cushion was tested as interface pressure with skin.	Only 13 cushions were effective. Gel and sheepskin had no pressure reducing effect; foams either increased or decreased pressure. Lowest interface pressure reported on air cushions and some foam cushions.
Defloor T, Grypdonck MFH. Pressure ulcers: validation of two risk assessment scales. *J Clin Nurs* 2005; 14:373-382.	Of 1772 older patients 314 randomly assigned to turning every 2h or 4 h + pressure-reducing mattress and 1458 assigned preventive care based on nurse judgment	RCT: Braden (,17=at risk) and Norton (<12=at risk) Scale used twice weekly on all patients. Diagnostic validity and accuracy measured for both scales compared with nurse prediction of PU development.	Using effective preventive measures decreased likelihood of developing a PU below what Braden or Norton predicted. Nurses predicted PU development less well than Braden or Norton scales
Dehlin O, Elmstahl S, Gottrup F. Monochromatic phototherapy: Effective treatment for grade II chronic pressure ulcers in elderly patients. Aging Clin Exp Res 2007;19(6):478-83.	163 elderly patients with stage 2 pressure sores.	RCT placebo controlled. Monochromatic pulsating light for 12 weeks	79% reduction in size versus 50% in the control p<0.05

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de Laat EH, Scholte op Reimer WJ, van Achterberg T. Pressure ulcers: diagnostics and interventions aimed at wound-related complaints: a review of the literature. J Clin Nurs. 2005 14(4):464-72.	All wound care modalities reporting measured effects of dressings on pain, odor or exudate management.	Systematic review of pressure ulcer outcomes dealing with pain (2 RCTs), odor (no RCTs, AHCPR, EPUAP Guidelines) and exudate management (6 RCTs).	HCD positively influences healing time (p<0.05) possibly because the absorption of exudate is more effective. Two topical anesthetics manage PU pain.
de Laat, E. H., Pickkers, P., Schoonhoven, L., Verbeek, A. L., Feuth, T., & van Achterberg, T. Guideline implementation results in a decrease of pressure ulcer incidence in critically ill patients. *Critical Care Medicine,2007; 35* (3), 815-820.	339 patients at risk of a PU during an ICU stay following surgery, trauma, cardiac respiratory neurologic, sepsis or other medical condition	EPUAP Grade 2-4 PU 'incidence density' i.e. per 1000 patient days and preventive transfer percentages were measured at baseline-3 mo, 3-6 mo and 12-15 months after implementing a PU protocol using Waterlow.	Grade 2-4 PU decreased from 54/1000 days at baseline to 42/1000 days at 3-6 mo to 32/1000 days at 12-15 mo. While transfer to an adequate matters increased from 28% at baseline to 40% at 3-6 mo to 60% at 12-15 mo.
Desneves KJ, Todorovic BE, Cassar A, Crowe TC. Treatment with supplementary arginine, vitamin C and zinc in patients with pressure ulcers: a randomised controlled trial. Clin Nutr. 2005 Dec;24(6):979-87. Epub 2005 Nov 15.	16 patients hospitalized with a Stage II, III or IV PU received standard hospital diet (SHD) or SHD + high protein and energy supplements or SHD + these supplements with arginine 9 g, vitamin C 500 mg and zinc 30 mg	Prospective RCT measuring dietary and anthropometric nutritional status and PUSH tool PU ulcer severity	No biochemical markers changed, PUSH scores improved significantly only in the group with supplemental arginine, vitamin C and zinc.
Dobrzanski, S., Kelly, C.M., Gray, J.I., Gregg, A.J., Cosgrove,C.N. Granuflex dressing in treatment of full thickness pressure sores. *Professional Nurse* 1990;5: 594-598.	DuoDERM (10) with DuoDERM Paste (11) vs DuoDERM CGF (11) with DuoDERM Paste (16)	Prospective RCT of full-thickness pressure ulcers dressed for up to 8 dressing changes.	DuoDERM CGF stayed in place without leaking 0.6-1.5 days longer than DuoDERM®. Adding DuoDERM Paste shortened wear time before addressing change was needed.
Durovic Maric D, Brdareski Z et al. . The effects of polarized light therapy in pressure ulcer healing. Vojnosanit Pregl 2008;65(1):906-12	40 patients with stage 1-3 pressure sores randomized to receive polarized light therapy or control.	Single blind RCT. Polarized light source (Bioptron) versus a control.	Significant reduction in wound surface area and PUSH score p<0.001 compared to control
Dyson R. Bed sores—the injuries hospital staff inflict on patients. Nurs Mirror 1978 Jun 15;146(24):30-32.	Post mortem of subjects. who received massage and subjects not massaged	Biopsies taken post mortem of a convenience sample of massaged or not-massaged patients.	Macerated, degenerated tissue in areas exposed to massage. Non-massaged subjects did not show these signs.

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Economides NG, Skoutakis VA, Carter CA. Evaluation of the effectiveness of two support surfaces following myocutaneous flap surgery. Adv Wound Care1995; 8: 49–53.	Roho dry floatation mattress (6) Clinitron bed (6)	RCT lasting 14 days after myocutaneous flap surgery. Primary outcome was prevention of ulcer recurrence .	No significant difference between groups in pressure ulcer recurrence.
Ek AC, Gustavson G, Lewis DH. The local skin blood flow in areas at risk for pressure sores treated with massage. *Scand J Rehabil Med* 1985;17(2):81-86,	15 subjects at risk of developing a PU	Prospective case series. All subjects had local skin temperature measured before and after receiving massage over bony prominences.	10 of 15 subjects with skin discoloration over their bony prominences had lower skin blood flow and skin temperature after massage than before (p< 0.01)
Evans E, Gray M. *Do topical analgesics reduce pain associated with wound dressing changes or debridement of chronic wounds?JWOCN 2005; 32(5):287-290*	Review of 24 references addressing topical management of chronic wound pain	LR answering questions of efficacy of topical wound care pain relief; safety and efficacy of EMLA (Eutectic Mixture of Local Anesthetics) cream as well as other topical pain relief	Level 1 evidence supports efficacy and safety of EMLA cream on chronic wounds including PU. Insufficient evidence to determine topical analgesis efficacy of 5% lidocaine gel, Lidoderm patches, lidocaine-soaked gauze or topical opioids.
Farage MA, Miller KW, Berardesca E, Maibach HI. Incontinence in the aged: contact dermatitis and other cutaneous consequences. Contact Dermatitis. 2007;57(4):211-7.	No RCTs or CTs on polypharmacy. One on diapers and skin damage, not clear this was PU damage.	Literature Review of causes of skin damage associated with incontinence	Polypharmacy, infection, decreased cognitive function all associated with incontinence and resulting skin damage, decreasing integrity of skin and increasing ease of damage.
Feedar JA, Kloth LC and Gentzkow GD. Chronic dermal ulcer healing enhanced with monophasic pulsed electrical stimulation. Phys Ther 1991;71(7):539	47 patients (50 wounds) with Stage II,III, IV pressure sores. Half assigned pulsed direct current (DC) half assigned control electrode (Control)	Double blind, RCT. Pulsed cathode electrical stimulation for 4 weeks measuring ulcer area and closure.	DC group: 56% decrease in size and 14% closed. This was significantly more decrease in size than the Control: 33% decrease in size and 8.25% closed
Fellin, R. Managing decubitus ulcers. *Nursing Management* 1984:15:29-30.	DuoDERM (2) vs Wet-to-dry gauze (2)	Prospective crossover study of daily costs to dress pressure ulcers.	Daily dressing cost with DuoDERM was lower ($1.09) than for gauze ($7.89)
Ferrell, B. et al, A Randomized trial of low-air-loss beds for treatment of pressure ulcers. JAMA, 1993; 269(4): 494-497.	Effectiveness of low-air-loss (LAL) beds for the treatment of pressure ulcers in nursing homes. 60 subjects in each group	RCT Subjects assigned (randomly) to either LAL or 10cm corrugated foam mattress.	LAL had a 3x improvement in the median rate of healing (compared to foam)P=.0002, deep and superficial ulcers

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Flam, E., Raab, L. Dressing surface fiction against bed sheets and adhesion forces of dressing to skin. Poster presented at 5th Advanced Wound Care Symposium, April 27-30,1991, New Orleans, LA, USA	DuoDERM CGF Extra Thin (sacral areas of 7 healthy volunteers)	Open label prospective study of friction levels similar to those of sheet friction against human sacral tissue. Sheer displacement forces applied were twice the friction forces.	DuoDERM CGF Extra Thin protected the skin from both friction and sheer forces applied without being dislodged from the skin or moving relative to the skin.
Flock P. Pilot study to determine the effectiveness of diamorphine gel to control pressure ulcer pain. J Pain Symptom Manage. 2003;25(6):547-54.	13 palliative care patients in a UK hospice with Grade II or III PU. Half received topical diamorphine opioid gel to control PU pain, half placebo.	Prospective RCT measuring PU pain before and after application of opioid gel or placebo.	7 patients completed the RCT Pain scores improved (p<0.05)) more after the diamorphine gel than after the placebo.
Fowler E, Scott-Woilliams S, McGuire J. Practice recommendations for preventing heel pressure ulcers. *OWM* 2008;54(10):42-57.	1 controlled study of 323 high PU risk surgical patients plus 2 CO references of heel PU during hip or knee surgery and variables associated with or predicting heel PU development.	LR including 1 prospective matched control RCT compared efficacy of multilayer pressure relief pad in O.R. and identified predictors of post-op heel PU within a broader LR of factors predicting heel PU, including Hb A1c $\geq$ 6.5.	Age >62, albumin level <3.5, Amer. Society of Anesthesia (ASA) score $\leq$ 3 predicted perioperative (most on heel) PU development. Multi-layer pressure relief pad reduced incidence of PU (23%) vs 52% in controls. CO studies cite 13-14% incidence of heel PU during hip or knee surgery with neuropathy or nerve block anesethesia
Fujioka M, Yoshida S, Kitamura R, Matsuoka Y. Iliopsoas muscle abscess secondary to sacral pressure ulcer treated with computed tomography-guided aspiration and continuous irrigation: a case report. Ostomy Wound Manage. 2008;54(8):44-8.	1 case of a 78-year-old with iliopsoas abscess secondary to a sacral pressure ulcer and hip replacement.	The infection was treated with immediate surgical debridement and drainage using computed tomography-guided aspiration with continuous irrigation.	Patient healed and received a flap graft 6 weeks after admission. Recovered within 2 months. Author concluded that computed tomography-guided aspiration may be as effective and less damaging than surgical debridement.
Gardner SE, Frantz RA, Bergquist S, Shin CD. A prospective study of the Pressure Ulcer Scale for Healing (PUSH). *J Gerontol Med Science*. 2005;60(1):93–97.	Convenience sample of 32 nursing home residents with at least one PU	6-month study in which PU were assessed weekly with PUSH and PSST. Surface area measurements were correlated with these assessments until PU healed or patient died.	Total PUSH scores were highly correlated with validated PSST and decreased among the 21 (66%) PU that healed during 6 months and did not among the11 (34%) that did not heal. These correlations with the validated PSST may not validate the PUSH scale for screening, diagnostic or predictive purposes.

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Gardner, Sue E, Frantz, Rita A, Schmidt, Frank L Effect of electrical stimulation on chronic wound healing: a meta-analysis, Wound Repair and Regeneration 7(6) 495-503 1999	Among the 4 PU placebo controlled trials: Electrical stimulation (9 studies, 130 PU patients) Placebo control (6 studies on 86 PU patients	Meta-analysis of % healing per week (PHW) including 4 placebo-controlled RCT on PU: 3 on 38 PU receiving Pulsed Direct Current (PDC), 1 on 35 PU Transcutaneous Electrical Neural Stimulation (TENS)	Overall evidence was strongest for PU: 16.6 PHW and 3.3PHW for controls (P< 0.05) Precise determination of the effective dose remains to be determined. The most evidence was on PDC.
Gardner SE, Frantz RA, Doebbling BN. The validity of the clinical signs and symptoms used to identify localized chronic wound infection. *Wound Repair Regen*. 2001;9(3):178-186.	36 chronic wounds (including 19 PU) with classic and 2ndary signs of infection	Cohort study. Of the 36, 11 (31%) contained 10,000 or more organisms per g of viable tissue in biopsies (high bioburden)	Delayed healing and friable granulation tissue were most sensitive correlates with high bioburden. Increasing pain, and wound breakdown had highest positive predictive value for high bioburden.
Golinko MS, Clark S, Rennert R, Flattau A, Boulton AJ, Brem H. Wound emergencies: the importance of assessment, documentation, and early treatment using a wound electronic medical record. Ostomy Wound Manage. 2009;55(5):54-61.	139 patients experiencing 200 consecutive admissions with web-based electronic medical records (WEMR) documenting diabetic foot ulcers, venous ulcers or PU 56% had non-PU.	Cohort study documenting treatment with initial sharp debridement and deep tissue culture and pathology from the wound base and/or systemic antibiotics.	38% had radiology- or pathology-confirmed osteomyelitis on admission supporting increasing wound pain, cellulitis, drainage or presence of significant undermining as indicators of invasive infection. Documenting with WEMR may alert to infection.
Gordon B.Conservative sharp wound debridement: state boards of nursing positions. J Wound Ostomy Continence Nurs. 1996;23(3):137-43.	Definitions and scope of application of conservative sharp debridement by registered nurses	Survey and literature review. Definition should include outline of appropriate educational preparation and clinical practice needed to ensure safe care.	Conservative sharp debridement is within the scope of practice of RNs who have been educated in it, with competency validation, and when coordinated with policy, procedures, physician orders.
Gorse, G.J., Messner, R.L. Improved Pressure Sore Healing with Hydrocolloid Dressings. *Archives of Dermatology* 1987;123:766-771.	Original DuoDERM (76 ulcers, 26 patients) Dakins wet-to-dry gauze (52 ulcers, 26 patients)	Prospective randomized study of weekly costs and healing of Stage II and III PU studied to healing, hospital discharge, or treatment failure.	More hydrocolloid-dressed ulcers healed (87% vs 69% for gauze), with lower weekly cost of supplies ($6.20 vs $52.50 for gauze).
Graumlich JF, Blough LS, McLaughlin RG, Milbrandt JC, Calderon CL, Agha SA, Scheibel LW. *J Am Geriatr Soc;* 2003; 51:147-154.	Medifil BioCore Collagen (35) daily DuoDERM CGF (30) twice per week	Prospective randomized controlled trial of ulcer healing during 8 weeks topical care of residents in 11 nursing homes in central Illinois.	Mean healing times and area healed per day were similar in the two groups. “Collagen was more expensive and offered no major benefits to patients otherwise eligible for hydrocolloid treatment.”

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Gray M. Is larval (maggot) debridement effective for removal of necrotic tissue from chronic wounds? *JWOCN* 2008;35(4):378-384.	1 retrospective chart review (18) wounds of various etiologies; 1 prospective comparison cohort (103) PU patients	SR searching MEDLINE and CINAHL for studies of larval therapy January 1960 to April 2008 measuring debriding efficacy or bioburden or infection	Maggot therapy was more likely to result in complete debridement by 5 weeks than conventional treatments with more granulation tissue coverage (Level C1)
Gregor S, Maegele M, Sauerland S, Krahn JF, Peinemann F, Lange S. Negative pressure wound therapy: a vacuum of evidence? Arch Surg. 2008;143(2):189-96	7 RCTs (324) and 10 non-RCTs (278) Of these, 2 RCT (Ford 2002, n=28; Warriner 2003, n=24) and no non-RCTs were on PU	SR of MEDLINE, EMBASE, CINAHL, and Cochrane Library of RCTs and non-RCTs of wounds treated with NPWT.Plus 1 RCT reporting no difference from modern dressings.	No PU RCT reported significantly improved PU change in wound size or healing compared to conventional wound therapy. Pooled data showed a reduction in wound size in favor of NPWT (p<0.05). 2/5 RCTs and 2/4 non-RCTs favored NPWT.
Guenter P, Malyszek R, Bliss DZ, Steffe T, O'Hara D, LaVan F, Monteiro D.Survey of nutritional status in newly hospitalized patients with stage III or stage IV pressure ulcers. Adv Skin Wound Care. 2000;13(4 Pt 1):164-8.	405 newly admitted hospitalized ICU patients with a Stage III or IV PU on their trunk were enrolled, 121 were included in analysis	Cohort study. Measures on admission: weight, prealbumin, albumin, nutritional intake, type of diet, gender,age type of PU,	Most patients >65, had a Stage III sacral ulcer, were below usual body weight, had low prealbumin level were malnourished.
Guihan M, Garber SL, Bombardier CH, Goldstein B, Holmes SA, Cao L. Predictors of pressure ulcer recurrence in veterans with spinal cord injury. J Spinal Cord Med. 2008;31(5):551-9	64 spinal cord injured residents in 6 VA Medical centers all of whom developed a recurrent PU	Variables associated with development of a recurrent pelvic PU were recorded and analyzed	Almost 50% had a prior PU at same location. African American race, high PU risk (Salzburg score), high Charlson co-morbidity score and longer sitting time prior to discharge.
Gunes U and Eser I. Effectiveness of a honey dressing for healing pressure ulcers. J Wound Ostomy Continence Nurs 2007;34(2):184-90.	36 patients with 68 stage 2-3 pressure sores. Honey dressing versus ethoxydiaminoacridine plus nitrofurazone	RCT of 5 weeks duration, measuring healing	Significant (4 fold) increase in healing rate in the honey treatment group p<0.001.
Gunes UY. A prospective study evaluating the Pressure Ulcer Scale for Healing (PUSH Tool) to assess Stage II, Stage III, and Stage IV pressure ulcers. *OWM* 2009;55(5):48-62.	Convenience sample of 72 patients with 86 PU Stage II (49%), Stage III (47%) or Stage IV (4%) PU	Prospective methodology study evaluated PUSH 3.0 validity during use on PU patients and literature review of studies validating PUSH tool and confirming predictive validity.	PUSH score total differed between healed and non-healed ulcers. It was practical easy-to-use and generally sensitive to change. However wound length x width was the key indicator that a wound was not healing. PUSH needs a PU size/depth scale.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Harding, K. Cutting K, Price P. The cost effectiveness of wound management protocols o care. *British J Nursing* (Suppl) 9(19): 1-10.	DuoDERM (9 studies: 281 ulcers) Comfeel (3 studies; 136 ulcers) Saline gauze (6 studies; 102 ulcers)	Retrospective literature review of weekly costs, healing and costs to heal Stage II and III PU studied to healing, hospital discharge, or treatment failure. Cost models generated by expert European Delphi panel	More DuoDERM®-dressed ulcers healed by 12 weeks (61% vs 51% for gauze or 48% for Comfeel), with lower cost to heal each wound for both hydrocolloid dressings than when gauze was used.
Harris CL, Fraser C. Malnutrition in the institutionalized elderly: the effects on wound healing. Ostomy Wound Manage. 2004;50(10):54-63.	2 studies supporting polypharmacy neither an RCT	Literature review	Polypharmacy can increase nutrient loss (e.g. antibiotics, diuretics, laxatives) and decrease appetite, or thirst causing confusion and delaying healing
Hengstermann S, Fischer A, Steinhagen-Thiessen E, Schulz RJ.Nutrition status and pressure ulcer: what we need for nutrition screening. JPEN J Parenter Enteral Nutr. 2007;31(4):288-94.	484 hospitalized elderly multi-morbid patients in Berlin, Germany assessed within 24 hours after hospital admission.	Prospective descriptive cohort study measured Norton PU risk, ADL (activities of daily living) BMI, BIA (bioelectrical impedance) and correlated these with PU development	PU prevalence was 16.6%. BMI decreased significantly in PU patients (p<0.008) No significant BIA prediction of PU but Age, ADL and BIA cell mass correlated significantly with Norton score
Henoch I, Gustafsson M. Pressure ulcers in palliative care: development of a hospice pressure ulcer risk assessment scale. Int J Palliat Nurs) 2003;9(11):474-84.	98 patients in a Swedish hospice between April 1999 and September 2000.	Prospective cohort study measuring pressure ulcer occurrence weekly. Modified Norton scale + 9 new scales were studied as PU predictors. Added results beyond abstract are cited in CMS contracted Qualidyne report on Outcomes at End of Life.	Increasing age, male gender, physical inactivity, immobility, decreasing food and fluid intake, incontinence, poor general physical condition and lean body constitution significantly predicted PU. Hospice PU Risk Assessment Scale (physical activity, mobility and age) was better than modified Norton with PPV 50%, NPV 100%
Heyneman A, Beele H, Vanderwee K, Defloor T. A systematic review of the use of hydrocolloids in the treatment of pressure ulcers. J Clin Nurs. 2008;17(9):1164-73.	28 RCTs comparing hydrocolloid dressings (HCD) to other dressings mainly on grade 2-3 (i.e.Stage 2-3) PU	Cochrane SR of healing, pain, absorption capacity and cost effectiveness . HCD were more cost effective than saline or povidone iodine gauze or collagen dressings and less cost effective than a hydrogel or foam dressing	HCD were more effective at healing PU (i.e. reducing PU dimensions) than gauze dressings and had more absorption capacity, less time for dressing change and pain on dressing change and fewer side effects than any form of gauze studied.

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Hodgkinson B, Nay R, Wilson J. A systematic review of topical skin care in aged care facilities. J Clin Nurs. 2007;16(1):129-36.	Topical skin care aged care facility	Systematic review. Searched CINAHL, Pubmed, Embase, Current Contents and Health Technology websites	No-rinse cleanser (includes 1 antimicrobial one) and disposable "bodyworns" may reduce incidence of incontinence induced PU. Bag bath useful in maintaining skin integrity.
Hofman A., Geelkkerken R. H., Wille J., Hamming J. J., Hermans J., Breslau P. J. Pressure sores and pressure-decreasing mattresses : a controlled clinical trial. *Lancet*, 1994, 343 : 568-71.	44 patients at high risk of developing a PU: compared foam core with multiple small foam cubes to a standard hospital mattress	Prospective RCT measuring incidence of new PU	Significantly reduced incidence of PU with the specialized foam mattress.
Hollisaz MT, Khedmat H, Yari F. A randomized clinical trial comparing hydrocolloid, phenytoin and simple dressing for the treatment of pressure ulcers. BMC Dermatol. 2004 Dec 15;4(1):18.	91 stage I & II pressure ulcers on 83 spinal cord injured individuals randomized to one of 3 groups: hydrocolloid dressing, simple gauze dressing (SD) or phenytoin cream (PC)	RCT 83 patients measured complete healing.	Phenytoin cream was less effective in healing than hydrocolloid but more effective than simple dressing. Complete healing in the HD group was better than the PC(P<0.01) or SD group (P<0.005).
Horn SD, Sharkey S, Hudak S, Gassaway J, James R, Spector W. Pressure ulcer prevention in long-term care facilities: A pilot study implementing standardized nurse aide documentation and feedback reports. Adv Skin Wound Care 2010; 23(3): 120-131.	11 not-for-profit LTC facilities in 7 states volunteered to participate in the "Real Time" program to integrate evidence-based PU prevention and management into CNA every day work flow.	Prospective HCT observational study, reporting quality measures (QM) to CMS on incidence or PU in high-risk clients 4th quarter 2003 and 3rd quarter 2005 after implementing AHCPR, & AMDA guidelines using a multidisciplinary team	CNA documentation forms reduced by 53%. Of 10 facilities engaged by 2004, 8 included at least 2 clinical reports into daily care. Clinical impact reported in 7 facilities: reduction in PU related QMand LTC center-acquired PU from 9.6 to 4.8 per center per quarter.
Houwing R, Rozendaal M, WoutersWesseling W, Beulens JWJ, Buskens E, Haalboom J. A randomized, double-blind assessment of the effect of nutritional supplementation on the prevention of pressure ulcers in hip fracture patients. Clin Nutr 2003; 22(4): 401–5.	103 hip fracture patients 51: supplement enriched with protein, arginine, zinc, antioxidants vs 52 non-caloric water based placebo enriched supplement and 52 placebo	Double-blind RCT lasting 28-days or to discharge measuring effect of nutritional supplements on incidence of PU after hip fracture. Note: 57% developed PU by day 2 after admission.	After a median 10 days of supplement, PU incidence was not different between groups of hip fracture patients. Conclusion was that supplementation may be more effective if initiated earlier. P = 0.09 in favor of supplement for stage II: 18% for enriched; 27% placebo.

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Hutchinson JJ, McGuckin M. Occlusive dressings: A microbiologic and clinical review. *Amer J Infec Control* 1990; 18(4):257-268.	Hydrocolloid (HCD) dressings (1351wounds; 35 studies); Occlusive films (1021; 28 studies); Foams (617; 12 studies);Non-occlusive dressings (1085; 36 studies)	Retrospective review and meta-analysis of published controlled and uncontrolled studies reporting clinically infected wounds from 1962 to 1990 on occlusive dressings (hydrocolloids, foams, films, gel dressings) vs non-occlusive dressings (gauze or alginates with no occlusive cover)	Infection rates were: 1.3% for HCD, 4.5% for occlusive films, 2.4% for foams and 7.1% for non-occlusively dressed wounds (p<0.001 for HCD vs non-occlusive). This trend was significant for pressure or venous ulcers, donor sites and surgical/other wounds, but not burns.
Ichioka S et al: Versatility of the Limberg flap and the V-Y flap (based on the distal perforator) for covering sacral ulcers. Scand J Plast Recontr Surg Hand Surg 2007:41(2):65-69.	110 patients with sacral pressures ulcers. Limberg flap versus gluteal V-Y.	Retrospective case series	Good long term results in local fasciocutaneous flaps in sacral pressure sores. 92% closure rate.
Isik FF, Engrav LH, Rand RP, Kierney P and Cardenas DD. Reducing the period of immobilization following pressure sore surgery: A prospective, randomized trial. 1997 August;100(2):350-354	42 patients after pressure sore surgery. Two versus 3 weeks of post op immobilization	Prospective randomized	No difference in complication rate (39-47%) P<0.493. Two weeks are better.
Institute for Healthcare Improvement [IHI] Program to Prevent Pressure Ulcers, http://www.ihi.org/IHI/Programs/Campaign/PressureUlcers.htm accessed January 17, 2007.	Guideline with implementation tools.		Malignancy mentioned as a risk to be addressed for PU
Jones KR, Fennie K. Factors influencing pressure ulcer healing in adults over 50: an exploratory study. J Am Med Dir Assoc. 2007;8(6):378-87. Epub 2007 Jun 14.	114 subjects with pressure ulcers managed with any types of dressings.	Retrospective structured data abstraction of cohorts of subjects in skilled nursing facilities (SNF) or other long term care or home care settings including 82 with 6 months of continuous care for which variables favoring healing were analyzed for their association with healing by 6 months.	Topical care variables associated with 6-month healing were: dressing type constant; use of HCD, modern, or exudate management dressings; avoiding gauze, non-silver antiseptics or mechanical debridement and failure to debride slough. % healed at 3- 6 months were Stage 2: 27.3-76.5%; Stage 3:10.2-33.3%;Stage 4: 2.5-13.3%

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Kantor J, Margolis DJ. Efficacy and prognostic value of simple wound measurements. *Arch Dermatol* 1998; 134: 1571-1574.	Retrospective cohort of 260 consecutive patients with wounds.	A prospective cohort study explored accuracy in estimating real planimetric wound area of: geometric length, width, area calculated as length x width, perimeter and eliptical area based on length x width	Geometric wound area estimates based on simple longest length x longest perpendicular width measurements were most strongly correlated with actual planimetric wound area for both large (>40 cm^2) and small wounds.
Kernozek TW, Wilder PA, Amundson A, Hummer J. The effects of body mass index on peak seat-interface pressure of institutionalized elderly. Arch Phys Med Rehabil. 2002;83(6):868-71.	Convenience sample of institutionalized elderly: (1) thin: BMI <20 (2) normal:BMI 20-24.9 (3) grade 1 obese: BMI 25-29.9 and (4) grade II obese:BMI 30-40 kg/m^2	Cross-sectional prospective descriptive compared peak seat-interface pressures of the 4 groups in several small nursing homes and a university in a small urban community.	Peak seat interface pressures were highest in the lowest BMI group: the thin elderly had significantly higher seat interface pressures than any other group. (p<0.05)s
Kerstein MD, Gemmen E, van Rijswijk L, Lyder CH, Phillips T, Xakellis G, Golden K, Harrington C. Cost and cost effectiveness of venous and pressure ulcer protocols of care. *Disease Management and Health Outcomes, 2001,* 9(11):651-663.	DuoDERM (9 studies: 281 ulcers) Comfeel (3 studies; 136 ulcers) Saline gauze (6 studies; 102 ulcers)	Retrospective literature meta-analysis of weekly costs, healing and costs to heal Stage II and III pressure ulcers studied to healing, hospital discharge, or treatment failure. Cost models generated by expert USA Delphi panel.	More DuoDERM®-dressed ulcers healed by 12 weeks (61% vs 51% for gauze or 48% for Comfeel), with lower cost to heal each wound using either hydrocolloid dressing than for gauze..
Konig M, Vanscheidt W, Augustin M, Kapp H. Enzymatic versus autolytic debridement of chronic leg ulcers: a prospective randomized trial. *J Wound Care*. 2005;14(7):320–323.	Chronic leg ulcers possibly including PU treated once daily with: Collagenase covered with dry gauze (27) Ringers-moistened polyacrylate dressing (15)	RCT. After 7 day wash out period, primary outcome was % of necrotic tissue removed (NTR) . Duration was originally set to 2 weeks, then extended to 3 due to outcome variability.	2 weeks: Collagenase: mean 10% NTR, autolytic mean 20% NTR, NS During week 3: autolytic experienced mean 11% more NTR, while collagenase experienced 11% increase in necrotic tissue burden.
Konishi C, Sugama J, Sanada H, Okuwa M, Konya C, Nishizawa T, Shimamura K. A prospective study of blanchable erythema among university hospital patients. *Int Wound J* 2008;5(3):470-5.	832 bed university hospital: 62 (24.9%) patients developed blanchable erythema. Of these 6 deteriorated to become a Stage I or II PU.	Skin condition, risk factors care plans and practices were measured daily for 4 weeks Of 187 who developed non-blanchable erythema, only 2 developed a PU	Blanchable erythema predicted PU development with 75% sensitivity, 77% specificity and a 3.26 positive likelihood ratio. Two factors associated with deterioration were pressure and inadequate maintenance of support surfaces.
Kordestani S et al. A randomised controlled trial on the effectiveness of an advanced wound dressing used in Iran. J Wound Care 2008;17(7):323-7.	54 patients with 60 wounds. Mixture of pressure sores, diabetic and leg ulcers randomized to chitosan or non-chitosan control.	RCT measuring rate of PU healing.	Significant increase in healing rate in the pressure ulcer group p<0.05 and in all 54 patients p<0.001.

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Kottner J Dassen T Interpreting interrater reliability coefficients of the Braden scale: A discussion paper. *International Journal of Nursing Studies* 2008; 45: 1238–1246	Braden scale reliability testing literature search of major databases	Literature review compared results of studies reporting inter-rater reliability of the Braden Scale using tools such as Cohen Kappa,, Pearson Product Moment correlation.	Intraclass correlation coefficient (r = 0.81 to 1.00 in studies reviewed) is the most appropriate measure of Braden scale inter-rater reliability, combined with overall percent agreement which varies among items.
Kranke P, Bennett M, Roeckl-Weidman I, Debus S. Hyperbaric oxygen therapy for chronic wounds. Cochrane Database System Review 2004; (2): CD004123	Searched Cochrane Library 2003, Medline 1966-2003, EMBASE 1974-2003, DORCTHIM 1996-2003 and reference lists of articles. Assess the benfits and harms of adjunctive HBOT for treating chronic diabetic foot ulcers, venous and arterial ulcers, and pressure ulcers.	Randomised studies comparing the effect on chronic wound healing of therapeutic regimens which include hyperbaric oxygen therapy (HBOT) with those that exclude HBOT (with or without sham therapy).	Five trials contributed to this review. No studies that satisfied inclusion criteria for pressure ulcers were located. The routine management of such wounds with HBOT is not justified by the evidence in this review. Any benefit from HBOT will need to be examined in further rigorous randomized trials.
Kurd SK, Hoffstad OJ, Bilker WB, Margolis DJ. Evaluation of the use of prognostic information for the care of individuals with venous leg ulcers or diabetic neuropathic foot ulcers. Wound Repair Regen. 2009;17(3):318-25.	Electronic databases within 74 centers were used to provide one of four kinds of feedback to wound care providers for patients with either a VU (n =1506) or a DFU (n = 1810). 4-week prognostic printout informed providers that the patient had or had not achieved 70% healing at 4-weeks	Each center was a “cluster” randomly assigned for wound care providers to receive either no prognostic information (20 centers), baseline prognostic information only (19 centers), prognostic information based on 4-week % wound area change (17 centers) or prognostic information at both baseline + 4 weeks	Both VU and DU healing improved on study. DFU patients with providers who knew only 4-week healing predictor were 1.5 times as likely to heal in 20 weeks than others. ($p < 0.05$), with no effect of other prognoses. VU patients with providers told either baseline or 4-week healing predictions or both were 1.4 times more likely to heal in 24 weeks than those who did not ($p< 0.05$).
Langemo D, Brown G. Skin Fails Too: Acute, Chronic, and End-Stage Skin Failure. Advances in Skin & Wound Care, 2006; 19(4): 206-212.	6 articles and 1 editorial [All descriptive Level C Evidence] describing acute, chronic and end-stage (terminal PU) skin failure	Systematic review. With irreversible acute illness, multiple chronic illnesses, or at end of life, PU prevention must be implemented with a realistic understanding of what can be achieved acknowledging that not all PU can be prevented.	Skin failure occurs when the skin and underlying tissue dies from hypoperfusion which resulted when there was severe dysfunction or multi organ failure. This occurs in the presence of a heavy disease burden and despite modern and comprehensive interventions

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Langemo DK, Black J and the NPUAP. Pressure ulcers in individuals receiving palliative care: A National Pressure Ulcer Advisory Panel White Paper©. *Advances in Skin & Wound Care,* 2010; 23(2):58-72.	A-level evidence criteria did not include CO studies for PU risk screening or diagnostic assessment as the AAWC did, so article evidence levels are lower than AAWC level	LR with 171 references addressing PU prevention and management in the palliative care setting. Most standard PU prevention and management recommendations have C-Level evidence in palliative care. Patient preference takes precedence.	PU risk higher with advanced age, protein-calorie deficit, immobility, friction and sheer and excess skin moisture. B-Level recommendations are: (1) heel protection and/or suspend leg to float heel (2) assess individual co-morbid conditions, nutritional status, PU psychosocial implications and cause; (3) assess PU tissue, exudate, odor and pain every shift, manage with topical diamorphine gel (4) dressings that (a) manage excess exudate to lengthen wear time and (b) reduce pain of dressing removal.
Langer G, Schloemer G, Knerr A, Kuss O, Behrens J. Nutritional interventions for preventing and treating pressure ulcers. Cochrane Database Syst Rev. 2003;(4):CD003216.	4 RCTs were evaluated on PU prevention 4 RCTs were evaluated on PU treatment	Cochrane SR of Nutritional interventions for PU overall trials were small and not high methodological quality.	1 RCT (Bourdel M, 2000) showed that nutritional supplements reduced incidence of new PU. 1 RCT supported mixed nutritional supplements; 1 RCT, zinc; 1 RCT proteins; 2 RCT ascorbic acid (Vitamin C)
Lanzafame RJ, Stadler I, Coleman J, Haerum B, Oskoui P, Whittaker M, Zhang RY. Temperature-controlled 830-nm low-level laser therapy of experimental pressure ulcers. Photomed Laser Surg. 2004;22(6):483-8.	9 C57BL mice / group with standardized PU created on back by pressure from magnetic discs for 3 12-h cycles. (A &B) daily light 830 nm, continuous, 5.0 J/cm^2 . Group C incandescent light 5.0 J/cm^2 .	Animal RCT. Groups A&B identical except that Group B had a special heat exchange device to maintain constant skin temperature to control for thermal effects of IR.	Group A and B PU closed in 18 days, Group C 25 days ($p<0.05$) % area decrease at 14 days: Group A: 75% or B:77% C:36% ($p<0.05$ for A=B>C) Maximum temperature change was 2°C in Group A, 0.2°C in Group B and 3.5°C in Group C. Effect is temperature independent .
Lazarus G, Cooper D, Knighton D, Margolis D, Pecoraro R, Rodeheaver G, Robson M. Definitions and guidelines for assessment of wounds and evaluation of healing. *Arch Dermatol.* 1994; 130:498-493.	Wound Healing Society supported operational definitions of concepts in wound assessment and evaluation techniques.	Literature review defining acute and chronic wounds, wound assessment, extent, burden and severity.	"Noninvasive assessment of extent includes perimeter, maximum dimensions of length and width, surface area, volume, amount of undermining, and determination of tissue viability."

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Leblebici B, Turhan N, Adam M, Akman MN. Clinical and epidemiologic evaluation of pressure ulcers in patients at a university hospital in Turkey. J Wound Ostomy Continence Nurs. 2007;34(4):407-11.	22834 patients admitted to a University Hospital in Turkey Jan 1-Dec 31, 2004 including 300 who developed at least one PU.	Measured predictive validity of Waterlow Scale for predicting PU development, stage or number of PU	360 PU developed(incidence 1.6%) Most PU (213) developed in ICU. There was a significant positive correlation between Waterlow score and number of PU that developed, but not with PU stage or development of 1 PU.
Lee, Posthauer, Dorner, Redovian & Maloney. Pressure ulcer healing with a concentrated, fortified, collagen hydrolysate supplement. 2006. 19(2) 92-96	N = 89 Compare (PUSH) scores at 8 weeks in long-term-care residents with Stage II, III, or IV PU given standard care plus a concentrated, fortified, collagen protein hydrolysate supplement(n =56) vs. residents who were given standard care plus placebo (n=33).	Randomized, prospective, controlled, multicenter trial at 23 long-term-care facilities in 4 states. Double blinded.	After 8 weeks of treatment, residents who received standard care plus the concentrated, fortified, collagen protein hydrolysate supplement had significantly better PUSH tool scores compared with those who received standard care plus placebo (3.55 ± 4.66 vs 3.22 ± 4.11, respectively; P < .05).
Lemaire V, Boulanger K and Heymans O: Free flaps for pressure sore coverage. Ann Plast Surg. 2008 Jun:60(6):631-634.	88 patients with 108 pressure sores and 141 flap procedures. Evaluation of free flaps need.	Retrospective cohort study	Free flaps were needed in 4.2 percent of cases when the defect was too big for local flap. The success rate was 80%.
Letizia M, Uebelhor J, Paddack E. *J Wound Ostomy Continence Nurs.* 2010;37(3):277-282.	27 references cited covering all goals of palliative wound care	Literature review addressing when and how to apply wound care to palliative patients	Care goals: manage pain; moist wound management to stabilize PU and reduce tissue trauma and pain during dressing change; manage exudate to reduce dressing change frequency; manage odor, prevent new wounds; prevent and manage wound infection; optimize patient mobility and function; ongoing assessment of pain and non-pain symptoms; educate and coordinate with all interdisciplinary team members, patient and family

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Lewis VL Jr, Bailey MH, Pulawski G, Kind G, Bashioum RW, Hendrix RW. The diagnosis of osteomyelitis in patients with pressure sores. Plast Reconstr Surg. 1988;81(2):229-32.	Osteomyelitis diagnostic tests (61 PU)	Prospective blind cohort study to assess usefulness of White cell count, plain pelvic x-ray, erythrocyte sedimentation rate,technetium-99m bone scan, computerized tomography, and Jamshidi needle bone biopsy	Jamshidi needle bone biopsy was best: sensitivity 73%, specificity 96%.Not indicated: technetium-99m bone scan, computerized tomography. Best non-invasive tests: any 1 of plain pelvic x-ray, white cell count, and erythrocyte sedimentation rate 89% sensitive, 88% specific.
Linares HA, Mawson AR, Suarez E, Biundo JJ. Association between pressure sores and immobilization in the immediate post-injury period. Orthopedics. 1987;10(4):571-3.	32 spinal cord injured patients who spent time in the Emergency Department (ED)16 developed a PU, 16 did not.	Retrospective case-controlled survey of patient recalling when they were first turned plus data on time spent in the Emergency Department. Data were correlated with PU development. Most who developed a PU took $\geq$ 3 hours in the ED. Those spent took $\leq$ t hours in the ED.	5 patients could not recall. Most others said they were first turned on the acute hospital ward, i.e. not in the ED. None of 14 patients with a PU who could recall care post injury recalled being turned in the ED. 13 patients without PU recalled being turned within 2 hours.
Lindgren M, Unosson M, Krantz AM, Ek AC. Pressure ulcer risk factors in patients undergoing surgery. J Adv Nurs. 2005;50(6):605-12.	286 adult patients undergoing surgery from 1996 – 1998 in a Swedish hospital	Prospective comparative study evaluated risk factors perioperatively and once weekly for up to 12 weeks after surgery measuring PU Risk Scale, food and fluid intake, body temperature and serum albumin	Those who developed a PU were significantly older, weighed less, had lower BMI and serum albumin. Risk factors from multiple stepwise regression were female gender, low Amer. Soc. Anesthesiologists and New York Heart Assn status and food intake.
Lyder CH, Preston J, Grady JN, Scinto J, Allman R, Bergstrom N, Rodeheaver G. Quality of care for hospitalized Medicare patients at risk for pressure ulcers. Arch Intern Med. 2001; 25;161(12):1549-54.	2425 Medicare patients $\geq$65 years of age discharged from acute care hospitals after treatment for pneumonia, cerebrovascular disease or congestive heart failure	Multicenter retrospective cohort study to evaluate processes used in acute care for PU prevention in the elderly, including processes in results column. National estimates of compliance were reported for each.	Daily skin assessment (94%); use of pressure-reducing devices (7.5%); documentation of patient PU risk (22.6%); reposition at least every 2 h (66.2%), nutritional consult (34.3%) in patients at nutritional risk and $\geq$ Stage II ulcer staging (30.9%)

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Lyder C. Shannon R, Empleo-Frazier O, McGeHee D, White C. A Comprehensive program to prevent pressure ulcers in long-term care: exploring costs and outcomes Ostomy/Wound Management 2002; 48(4):52 – 62.	302 clients including 203 at high Braden scale risk of developing PU in two long-term care facilities (one with 110 beds and one, 150 beds) 5 months prospective results were compared with up to 5 months of retrospective data abstracted from client charts in the same facilities January 1-June 30, 1999.	Prospective quasi-experimental cohort study used a validated reliable chart abstraction tool to measure PU incidence for retrospective controls compared to prospective test subjects. Cost effectiveness was measured on 2 sets of 10 matched subjects randomized to receive care according to a validated protocol of care or care not adhering to this protocol.	Using the validated protocol of care (Solutions®), both facilities decreased PU incidence significantly from 13.2% to 1.7% and 15% to 3.5% (both p values 0.02). Average monthly cost for PU prevention for a high-risk resident was $519.73 plus a one time cost of $277 for mattress and chair overlays. These are less than the costs of PU management or fines for PU development or deterioration in long term care.
Magnan MA, Makelbust J. Web-based training in using the Braden Scale to predict pressure sore risk. *Adv Skin Wound Care*2008;21(3):124-133.	1391 Registered Nurses at 3 midwest USA medical centers	Pre-post prospective cohort study evaluating accuracy of identifying Braden PU risk levels before and after web-based training on nursing knowledge of PU assessment and prevention	After training, 82.6% of nurses correctly rated PU risk on Braden Scale. Not at risk and high or very high risk were more accurately identified than mild or moderate risk.
Makelbust J, Magnan MA. A quasi-experimental study to assess the effect of technology-assisted training on correct endorsement of pressure ulcer preventive interventions. *OWM* 2009; 55(2):32-42.	102 Patients at 3 hospitals with 580 or 685 beds (both of which used Braden Scale daily), or 450 beds (Clinical PU prevention skills were tested for 12 experienced Braden users and 1391 new Braden user RNs .	Convenience-controlled trial (CCT, also called quasi-experimental study) recorded pre- and post-training use of 10 Expert-rater intervention checklist (Ex1C) PU prevention measures on low (15-18), medium (13-14) or high (Braden 10-12) risk PU patients	Mid-level risk patients received appropriate PU prevention measures least frequently both pre- and post-training for all professionals. “New Braden Users” improved on assigning Ex1C PU prevention to patients at risk of a PU. This is added analysis of Magnan and Makelbust 2008.
Mannesse CK, van Riet GJ, van der Cammen TJ. Unusual consequence of a fall: pressure sores of both breasts resulting in bilateral partial mastectomy. Neth J Med. 1994;45(1):30-3.	1 elderly patient in Rotterdam, Netherlands	Presented with hypothermia after lying prone for 48 hours after a fall	Developed PU on both breasts resulting in bilateral partial mastectomy.
McDonald A, Lesage P. J Palliative management of pressure ulcers and malignant wounds in patients with advanced illness Palliative Medicine, 2006, Apr;9(2):285-95.	Review of literature in the palliative care setting.	LR Level C - EO	Prevention, management, and efforts to heal wounds if possible are fundamental tasks in palliative care. Includes manage pain,infection, bleeding,odor, pruritis, drainage, and psychosocial distress.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
McInnes, E et al, Support surfaces for pressure ulcer prevention (Review). The Cochrane Collaboration. 2008,Issue 4	Review of literature – RCTs that assessed the beds, mattresses. Overlays and seating cushions for effectiveness in preventing pressure ulcers – any patient, any setting. 11 trails included – 52 RCTs	RCTs published or unpublished from Cochrane Central Register of Controlled Trials, Ovid MEDLINE 1950 – 2/08, Ovid EMBASE 1980 – 2008, and ovid CINAHL 1982 – 2/08. Data pooled in a meta analysis.	Foam can reduce incidence of pressure ulcers vs standard mattress Pressure –relieving overlays used on OR tables reduce postoperative pressure ulcer incidence Overlays on ER trolleys did not show a reduction in incidence
McIsaac C. Managing wound care outcomes. *Ostomy/Wound Management* 2005; 51(4):54-68.	DuoDERM®, AQUACEL® , SurePress® Profore® used in adaptation of *Solutions*® standardized algorithms of care.	Prospective real-world outcomes study from 1999 through 2003 in Nova Scotia, using the Nova Scotia Protocol in home care adapted from *Solutions*® algorithms of wound care	Decline from averages of 3 years to heal pressure, venous, diabetic ulcers to less than 6 months, while saving Nova Scotia an average of $2039 per client / month.
Meaume S, Van De Looverbosch D, Heyman H, Romanelli M, Ciangherotti A, Charpin S. A study to compare a new self-adherent soft silicone dressing with a self-adherent polymer dressing in stage II pressure ulcers. Ostomy Wound Manage. 2003 Sep;49(9):44-51.	Soft silicone foam dressing (Mepilex Border®: 18) Hydropolymer foam dressing (Tielle®: 20)	Eight-week open multi-center RCT measuring wound healing, odor, leakage, surrounding skin and ease of dressing removal.	Similar percents of both dressing groups healed. Both dressings were changed about once weekly. There were no differences in signs of inflammation, amount of exudate, odor or leakage. Silicone-dressed PU experienced less damage, maceration and removal difficulties.
Meaume S, Vallet D, Morere MN, Téot L. Evaluation of a silver-releasing hydroalginate dressing in chronic wounds with signs of local infection. J Wound Care. 2005;14(9):411-9.	Silver-releasing hydroalginate (Silvercel: 51 chronic wounds including ~14 PU) Calcium alginate dressing (Algosteril: 48 including ~14 PU)	4-week RCT of chronic wounds with signs of local infection, measuring decrease in wound severity score at week 4 and percent reduction	More percent and absolute decrease in wound severity score in the Silvercel® group over 4 weeks.
Milne CT, Triglia D, Houle TL, DeLong S, Rosenblum D. Reducing pressure ulcer prevalence rates in the long-term acute care setting. *OWM*, 2009;55(4):50-59.	108-bed Long Term Acute Care Hospital (LTACH)	Prospective cohort study used Failure Mode Effects Analysis to reduce PU prevalence and improve PU care processes, developed staff education, team, documentation methods and electronic med records	Implementation reduced PU prevalence from 41% at baseline to mean of 4.2% during the following 12 months and decreased missing medical record data to < 1%

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Milne CT, Barrere CC, McLaughlin T, Moore A. Surgical hip dressings: a comparison of taping methods. *Orthop Nurs* 1999; 18(3):37-42.	148 consecutive hip surgeries, with gauze dressing held in place with tape to either: Tape to skin Tape to DuoDERM® Tape to Stomahesive®	Convenience controlled trial (CCT) measuring incidence of blisters developing around the surgical site due to tape damage.	Tape-induced blisters developed on 17% of sites in the Tape to skin group, 0% of sites with Tape to DuoDERM® or Stomahesive® but Stage I PU were reported at Stomahesive® corners
Mody GN, Nirmal IA, Duraisamy S et al. A blinded prospective randomized controlled trial of topical negative pressure wound closure in India. *OWM* 2008;54(12):36-46.	Patients: 15 diabetic foot ulcers (6 TNP, 9 C); 11 PU (2 TNP, 9C); 11 cellulitis/ fasciitis (3 TNP, 8C); 11 "other" (4 TNP, 7C). TNP+ sterile porous packing material changed Q 2 days; Control: saline gauze covered with dry pads changed twice daily. Only 2 PU received TNP.	Prospective double-blind RCT, with patients randomly assigned after debridement to TNP wall suction at 125 mm Hg cycling 2 minutes on/ 5 minutes off. control mean duration of follow up 26 days for controls; 33 days for TNP. Measures: wound area and days to satisfactory healing (i.e. 2nd intent healing or readiness for delayed primary closure.)	47.6% of TNP wounds and 48.4% of C wounds achieved satisfactory healing (NS). TNP-treated PU averaged 10±7 days to heal and control PU 27±10 days ($p<0.05$). Total material costs to achieve satisfactory healing was $11.35 each for 2 representative PU treated with TNP and $22 for 2 similar control PU. Complications were comparable except for leg pain or cramps in TNP group.
Moore Z, Cowman S. A systematic review of wound cleansing for pressure ulcers. J Clin Nurs. 2008;17(15):1963-72.	Systematic review	Cochrane process followed. Insufficient RCTs for meta analysis or firm conclusions. "There is little trial evidence to support the use of any particular wound cleansing solution or technique for pressure ulcers"	No RCTs compared cleansing to no cleansing. Statistically better healing with saline spray containing Aloe vera, silver chloride and decyl glucoside compared to isotonic saline ($p=0.025$). No difference between water and saline or with vs without whirlpool
Mulder GD. Treatment of open skin wounds with electric stimulation. Arch Phys Med Rehabil. 1991 May;72(6):375-7	59 patients (67 wounds) pressure, vascular and post surgical. JT please provide N for each treatment group	Double blind, RCT 14 weeks. Electrical stimulation versus sham stimulation.	56% decrease in size versus 33% in the sham group.
Munro BH, Brown L, Heitman BB. Pressure ulcers: one bed or another? Geriatric Nurs 1989; 10: 190–2.	Patients with a Stage II or III PU Clinitron® (8) or Standard Mattress plus gel or other off-loading devices (10)	Prospective RCT. PU area measured on days 1,3,8 and 15. Repeated measures ANOVA compared group reduction in PU size	PU size reduced more during 15 days for patients on Clinitron® bed than with standard care associated with trend ($p=0.06$) toward more patient satisfaction.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Munter KC, Beele H, Russell L, Crespi A, Grochenig E, Basse P, Aliksidic N, Fraulin F, Dahl C, Jemma AP. Effect of a sustained silver-releasing dressing on ulcers with delayed healing: the CONTOP study. J Wound Care 2006; 15(5):199-206.	Contreet® Foam (100 mg zeolyte silver-sodium hydrogen zirconium phosphate ceramic complex in foam (26 with PU) or gauze or other local best practice dressings (21 with PU)	Prospective open-label parallel, block randomized 4-week study measuring healing, pain at or between dressing changes, malodor	After 4 weeks the silver foam dressed PU decreased 58.5% in wound area compared to 33.3% reduction in wound area for the gauze or local best practice PU.
Murphy RC, Robson MC, Heggers JP, et al. The effect of microbial contamination on musculocutaneous and random flaps. J Surg Res 1986; 41: 75–80.	Animal study	random or musculocutaneous flaps grafted onto granulating wound beds containing 10^4, 10^5, or 10^6 bacteria per gram of tissue	In wounds with minimal bacteria, both flaps took and wounds healed. Intermediate group only wounds with musculocutaneous flaps healed; high count: neither took. “Therefore inmoderately contaminated wound, musculocutaneous flaps are … can decrease bacterial counts and obtain successful closure when random flaps cannot.
Nakagami G, Iizaka S, Kadona T, et al., Prediction of delayed wound healing in pressure ulcers by thermography. *Proc. 41st Annual WOCN Conference*, St. Louis, MO. Research Poster #3441. *JWOCN* 2009; 36(3S):S65	N = 33 non-infected Stage II to IV pressure ulcers enrolled on admission to a Japan hospital setting.	Thermography measured wound temperature (WT) and surrounding skin temperature (ST) right after dressing removal on patient enrollment and used a ratio of WT/ST> 1.0 as a screening tool to predict “clinical delayed healing” defined as failure to contract during the next 3 weeks during best practice PU management	PU with initial WT/ST > 1 were 6.3 times more likely to fail to contract during the next 3 weeks of care than if WT/ST $\leq$ 1 ($p \leq 0.02$). As a diagnostic tool, WT/ST >1 identified 8 of 11 non-healing wounds (73% sensitivity) and 20 of 22 normally healing wounds (91% specificity). As a prognostic or screening tool, 8 of 10 PU with WT/ST >1 on enrollment failed to contract during the next 3 weeks (80% positive predictive value); 20 of 23 PU with WT/ST $\leq$ 1 healed normally (87% negative predictive value). Overall accuracy was 85% (28 of 33 PU outcomes correctly predicted before other signs of inflammation were visible).

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
NICE (National Institute for Clinical Excellence), Royal College of Nursing, The management of pressure ulcers in primary and secondary care: A Clinical Practice Guideline. September 22, 2005.	Review of studies on PU management in primary and secondary care settings. Uses European PUAP grading method.	Evidence-based guidelilne suggesting immediate implementation of PU grade and documentation of all items in PUCI outline including tracings and photographs with ruler, measuring longest length and longest width as an estimate of surface area; remove/reduce cause, plus treatment items to right: Level 1 evidence supports use of only NPWT, ES as adjunct therapies .	Patients with PU should have 24/7 access to support surfaces, including HSF support for Grade 1-2 gauze and AP device or if deteriorating or Grade 3-4, LAL, AFB , AFT or VF bed (with no conclusive evidence of differences between these pressure relieving devices) Optimize wound environment using HCD, HF or other modern dressings avoiding simple pads, gauze or impregnated gauze
Nicosia, G et al, The effect of pressure-relieving surfaces on the prevention of heel ulcers in a variety of settings: a meta-analysis. International Wound Journal, 2007, Vol 4 No 3	Meta-analysis of pressure-relieving intervention on the incidence of heel ulcers in various settings	Literature search of Nursing, Allied Health lit, MEDLINE, PubMed, EMBASE and Cochrane datbases. English language articles dealing with prevention interventions for heel ulcers. 14 studies, 1457 subjects, 105 articles reviewed.	Supports the use of foam or air mattress or overlay vs standard mattress to reduce the risk of heel pressure ulcer development. Foam mattresses associated with lover risk of heel ulcer development. Insufficient data to determine the effectiveness of heel protective devices on the prevention of heel ulcers
Nixon J, Cranny G, Iglesias C., Nelson EA, Hawkins K, Phillips A, Torgerson D, Mason S, Cullum N and the PRESSURE Trial Group. Randomised, controlled trial of alternating pressure mattresses compared with alternating pressure overlays for the prevention of pressure ulcers: PRESSURE (pressure relieving support surfaces) trial. BMJ, doi:10.1136/ bmj.38849.478299.7C (published 1 June 2006)	1972 patients admitted to 11 hospitals - admitted as elective or acute. 818 of 990 allocated received alternating pressure overlay (APO). 804 of 982 allocated received alternating pressure mattress (APM). 349 or 17.7% were not placed on the randomly assigned support surface, no statistical difference in baseline risk factors.	RCT comparing staff and patient preferences and performance measures for APO and APM. Measures included: PU area, healing rate and patient risk factors for developing a PU; incidence of new PU within 30 days; cost analysis based on Kaplan Meier estimates of delay in ulceration. Outcome measures were not blinded to group assignment.	Groups were comparable at baseline on PU risk. There was no difference in % of patients developing a pressure ulcer Grade 2 or worse (p=0.75) or in healing time of the 113 PU existing on enrollment. More overlay subjects (23.9% vs 18.9% of mattress patients p= 0.02) subjects requested a change in pressure support product. APM was more cost effective based on delay of ulceration and resulting shorter length of hospital stay.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Nussbaum EL, Biemann I, Mustard B.Comparison of ultrasound/ultraviolet-C and laser for treatment of pressure ulcers in patients with spinal cord injury. Phys Ther. 1994;74(9):812-23; discussion 824-5.	1. Good nursing care (6) wound cleansing twice daily with Hygeol* (1:20),+ Jelonet dressing + avoidance of lying on PU. 2. Laser 820 nm, 120 mw/cm2 3 x /week (6) Ultrasound-UVC (6) with a 5 cm^2 head 3 MHz at SATA intensity of 0.2w/cm2 (1:4 pulse ratio)+ UVC 250 nm 15 min differed at each wound-session	Prospective CCT every 2 weeks until PU was healed. Measured area from tracings (blinded to treatment group) and maximum wound depth. Unit of study is wounds, not subjects. 16 subjects completed study, 1 each withdrew from laser and US-UVC arms and 2 from control group.	Mean healing time 4.1 weeks. NS difference between groups in healing time. Mean % change in area per week was highest for US-UVC group. No effect of laser therapy.
O'Brien M. Debridement: ethical, legal and practical considerations. Br J Community Nurs. 2003 Mar.:23-5.	Perspective on methods of debridement	LR of debridement methods focusing on ethical, legal and clinical practice considerations	Conservative sharp debridement is an important and valuable option for managing many patients with necrotic tissue in wounds.
Ochs RF, Horn SD, Van Rijswijk L, Pietsch C, Snout RF. Comparison of air fluidized therapy with support surfaces used to treat pressure ulcers in nursing home residents. Part 1-3, Ostomy/Wound Management, 2005; 51(2) : 38-68	All LTC residents ≥ 18 years old with ≥ 14 day length of stay from Feb 1, 1996- Oct 31, 1997: Group 1 (463): Dry, gel or air overlay replacement mattress. Group 2 (119): powered and non-powered overlay and low-air-loss or alternating pressure surface. Group 3 (82) air-fluidized support surface	Retrospective HCT or 3-month duration comparing healing rates of Stage II through Stage IV PU managed with different Groups of support surfaces using PU healing data from the national pressure ulcer long term care study (NPULS). Baseline area of ulcers placed on Group 1 < Group 2 < Group 3 (p< 0.0001)	Greater healing rate (Mean cm^2 per week) for Stage I/II (p=0.023) or for Stage III / IV pressure ulcers (p=0.026) on Group 3 as compared to Groups 1 and 2 support surfaces.
Ohura T, Sahada H, Mino Y. Clinical activity-based cost effectiveness of traditional versus modern wound management in patients with pressure ulcers. *Wounds* 2004; 16(5):157-163.	Pressure ulcers: Stage II and III in hospitalized patients in Japan with modern care hydrofiber + hydrocolloid using algorithm (29)traditional care (medicated gauze) + Algorithm (34) or TC/no algorithm (20)	Prospective controlled trial comparing cost & healing effects of modern versus traditional dressings using a standardized algorithm of wound care to no algorithm and traditional (gauze) care PSST score measured PU improvement outcome.	Hydrocolloid and hydrofiber used in a consistent protocol of care (algorithm) reduced PSST scores consistently more (p=0.046) and more cost effectively (p=0.044) than gauze-based protocols of care.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Ohura N, Ichioka S, Nakatsuka T, Shibata M. Evaluating dressing materials for the prevention of shear force in the treatment of pressure ulcers. J Wound Care. 2005;14(9):401-4.	STD HCD D2 (7) Hydropolymer (7) Hydrofoam (7)	Prospective in-vitro study measured coefficient of friction between the outer dressing layer and fabric, adhesiveness between the inner dressing layer and skin, as well as transmission of shear force by the dressing.	Lowest coefficient of static friction for HCD (0.48); or 1.01 for hydropolymer, 0.72 for hydrofoam. Lowest shear transmission for hydrofoam.
Olyaee Manesh A, Flemming K, Cullum NA, Ravaghi H. Electrmagnetic therapy for treating pressure ulcers. Cochrane Database Syst Rev, 2006 Apr 19; (2); CD002930.	2 RCT's with total of 60 participants from original first LR in 2001. 1 30 subject sham comparison with stage II/III PU & 1 three-armed study with 30 stage II/III PU standard care comparison. No new trials were identified in this 2006 update.	LR; RCT studies comparing electromagnetic therapy with sham served as the search criteria. MA was utilized to combine trial results.	No statistically significant difference in healing between the control group & the electromagnetic therapy group. Further research is needed to establish beneficial or harmful effects of electromagnetic therapy on wound healing.
Pancorbo-Hidalgo PL, Garcia-Fernandez FP, Lopez-Medina IM, Alvarez-Nieto C. Risk assessment scales for pressure ulcer prevention: a systematic review. J Adv Nurs. 2006; 54(1):94-110.	Braden Scale [cut-off 14-20](20 studies total n = 6443) Norton Scale [cut-off 14-16] (5 studies total n =2008) Waterlow [cut-off 10-16] (6 studies total n = 2246)	Meta-analysis of more than 20 studies on more than 6443 patients. RN, ET, GSN, or LPN rated risk of subjects aged 50-81 years in all settings.	Braden scale had highest % correctly classified at risk who ultimately developed a PU. In order of Braden, Waterlow, Norton Scale: % correct: 67, 60, 34 Sensitivity: 57, 47, 82 Specificity: 68, 62, 27 +Pred value: 23, 18, 16 - Pred value: 91, 87, 89
Paul J, Pieper B. Topical metronidazole for the treatment of wound odor: a review of the literature. *Ostomy Wound Manage.* 2008;54(3):18-27.	15 studies using metronidazole (M) to reduce wound odor, 2 were prospective double blind RCTs	Literature review of studies reporting M effect on wound odor reduction.	One RCT (n=41, 5 with a PU) reported faster pain reduction with M than placebo. 1 RCT (11 patients with fungating wounds) NS difference. Daily wound cleaning improved odor in both study controls.
Payne WG, Posnett J, Alvarez O, Brown-Etris M, Jameson G, Wolcott R, Dharma H,Hartwell S, Ochs D. A prospective randomized clinical trial to assess the cost-effectiveness of a modern foam dressing versus a traditional saline gauze dressing in the treatment of stage 2 pressure ulcers*OWM* 2009:55(2):50-55	36 patients with Stage II pressure sores. Saline gauze versus Polyurethane Foam wound dressings.	Prospective randomized controlled trial measuring healing rate, frequency of dressing change and wound care costs.	No differences in wound healing rate. Less dressing change and less cost in the foam group.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Pemberton V, Turner V, VanGilder C. The effect of using a low-air-loss surface on the skin intetrigy of obese patients: Results of a pilot study. *OWM* 2009; 55(2):44-48	21 consecutive obese patients (BMI >35) with mean Braden score 14.7 (range 9-21), including 11 on ICU. Six has 10 PU total	Historic controlled trial measuring PU area and incidence of new PU pre- vs post- implementation of low-air-loss surface.	No new PU developed and existing Stage I or II PU reduced in area from 5.2 cm^2 to 2.6 cm^2 during a mean of 4.6 days (range 2 to 8 days) on the low-air loss surface.
Pinchcofsky-Devin G. Why won't this wound heal? Ostomy Wound Manage. 1989 Fall;24:42-51.	No new patients. Nutritional deficits are more common in elderly than previously supposed.	Literature review. In order to plan nutritional interventions to reduce incidence or severity of PU must first assess patient.	Detailed tool for nutritional assessment is included in article. Items in tool validated by earlier correlation study
Pinchcofsky-Devin G, Kaminski MV. Correlation of pressure sores and nutritional status. JAGS. 1986; 34(6): 435-440.	232 nursing home residents (128 women, 104 men) mean age 72.9 years Patients were all compared with HANES standards. PU were Stage I-I V.	Cohort study determined anthropometric (weight, triceps skinfold, mid-arm circumference, arm muscle circumference) & biochemical (serum albumin (Severe<2.5, Moderate<3-2.5, Mild <3.5-3.0), pre-albumin, total lymphycyte, total protein % deficit: severe >30, Moderate >15-30, Mild >5-15) measurements and presence of $\geq$ 1 PU	Incidence of malnutrition was 59%. 70.5% had protein and vitamin deficiency (kwashiorkor-like) 5.8% had protein-calorie deficiency (marasmus). 23.5% had all 3 All 17 patients with PU were severely malnourished. Serum albumin <3.3 g% and TLC <1220 mm were significant predictors of PU. PU Stage correlated significantly (r=0.96) with serum albumin.
Polliack AA, Scheinberg S. A new technology for reducing shear and friction forces on the skin: Implications for blister care in the wilderness setting. *Wilderness and Environmental Medicine* 2006; 17:109-119.	Pre-clinical: coefficient of friction (CoF) testing on 10 friction and shear-reducing bandages plus Bursatek®. (B) Clinical test of Bursatek on 15 healthy female volunteers	Prospective controlled preclinical study measuring CoF. Prospective case series measuring CoF 3 times on each subject under standardized shear simulating clinical use over a bony prominence.	Preclinical CoF was 0.57 for B, the lowest CoF, Other dressing CoF values ranged from 0.67 (Moleskin®) to 1.54 (Tegaderm®) . Mean clinical maximum CoF value before dressing dislodgement was 0.225 (range 0.095-0.432)
Powers. A multidisciplinary approach to occipital pressure ulcers related to cervical collars. Journal of Nursing Care Quality1997.Oct. 12(1)46-52	Occurrence of occipital pressure ulcers	Descriptive uncontrolled study	PU incidence with cervical collars reduced to 0 with multidisciplinary approach

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Pullen R. Popp R, Volkers P, Fusgen I. Prospective randomized double blind study of the wound-debriding effects of collagenase and fibrinolysis/deoxyribonucleas e in pressure ulcers. *Age and Aging* 2002; 31(2):126-130.	Two debriding ointments compared on elderly patients with pressure ulcers: Collagenase (44) Fibrinolysin / deoxyribonuclease (34)	Prospective double blind RCT measuring change of necrotic wound area.	Change in necrotic wound area was slightly but not statistically significant for the collagenase group.
Quigley SM, Curley MA. Skin integrity in the pediatric population: preventing and managing pressure ulcers. J Soc Pediatr Nurs. 1996;1(1):7-18.	All PICU patients with Braden Q<23 in a 325-bed tertiary care pediatric hospital in 1994	Prospective descriptive cohort study subjecting participants to PU prevention skin care and dynamic pressure relief overlay algorithm, and PU treatment algorithm.	Consistency of PU care and prevention increased. Team recommended Braden Q for risk assessment of pediatric patients and the PU prevention and treatment algorithms for management.
Ramundo J, Gray M. Enzymatic wound debridement. J Wound Ostomy Continence Nurs. 2008 May-Jun;35(3):273-80.	9 RCTs including 2 on PU (n = 40) and 2 on leg and pressure ulcers. Enzymes studied were collagenase and/or papain urea.	Systematic Review summarizing necrotic tissue removal results Healing outcomes were not related to debridement.	PU (n = 26) were debrided more rapidly with papain-urea than with collagenase enzymatic debridement. One venous ulcer study showed more rapid autolytic debridement than with collagenase.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Ramundo J, Gray M Is ultrasonic mist therapy effective for debriding chronic wounds? J Wound Ostomy Continence Nurs. 2008;35(6):579-83.	Systematic review 2 RCTs of ultrasound mist therapy, both on diabetic foot ulcers.	MEDLINE and CINAHL DATABASES were searched from January 1996 to February 2008.	No RCTs were found to support safety or efficacy of ultrasonic mist therapy on pressure ulcers.
Reddy M, Keast D, Fowler E, Sibbald RG. Pain in pressure ulcers. Ostomy Wound Manage. 2003;49(4 Suppl):30-5.	Review		"Integrating pain management into a treatment paradigm for pressure ulcers canlead to improved outcomes."
Reddy M, Gill S, Rochon P. Preventing pressure ulcers: a systematic review. JAMA, 2006; 296(8): 974-984	Systematic review of 59 PU prevention RCT interventions targeting: -51 studies impaired mobility on (n): 7984 acute care, 1866 LTC, 333 rehab, 1368 mixed settings. -5 studies on impaired nutrition (n=1475)—one well-designed large trial (n=351) supported adding a nutritional supplement to standard hospital diet to reduce PU incidence and one did not. Mixed results from possibly underpowered studies -3 studies on skin health one reporting fewer PU with hyperoxygenated fatty acid compound vs placebo (n=331) and one reporting fewer PU in acute care subjects given hexachloro-phene, squaline, allantoin lotion (n=167); no effect of nicotinate.	Search of Medline, Embase, CINAHL and Cochrane databases though June 2006 to identify relavent RCTs (n). Dynamic support surfaces (SS) included Alternating pressure (AP) mattresses, low air loss beds (LA) and air fluidized beds (AF). Static SS included specialized foam (SF), gel or sheepskin overlay or mattress Rotating SS: reported no reduction in PU Incidence compared to AP (2 studies; n=147) Repositioning, Exercise and Incontinence Intervention: Turning q 4 h on a SF mattress reduced PU I more than turning Q 2 or 3 h on standard hospital mattress, turning q 8 h on SF mattress or standard care based on clinical judgment. Better evidence needed for nutrition & skin health	Static vs Standard SS -Specialized foam (SF) reduced PU incidence (I) more than standard (std) mattresses or OR tables (5 studies, n=976) with no difference in SF SS (5 studies, n=486) and 5 SF studies showing no effect (n=1524). -Sheepskin SS + heel and elbow protection reduced PU I more than std mattresses or OR tables (2 RCT; n= 686) -Polystyrene bead SS + heel protection reduced PU I more than std SS (1 study n=75) Dynamic vs Standard SS -Low air loss (LAL) reduced PU I more than AP (2 studies; n=160) - AP better than OR table + gel pad (1 study, n=170) and AP differ in PU prevention effects (1 study; n=66)
Redelings MD, Lee NE, Sorvillo F. Pressure ulcers: more lethal than we thought? Adv Skin Wound Care. 2005;18(7):367-72.	114,380 persons with PU reported as cause of death in US national multiple cause coded database 1990-2001.	Descriptive study with matched odds ratio comparisons of PU-associated deaths with deaths due to other conditions	PU was reported as cause of death in 3.79 per 100,000 of the population. PU were associated with fatal septic infections. Mortality rates in blacks were higher than other racial/ethnic groups.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Reed RL, Hepburn K, Adelson R, Center B, McKnight P. Low serum albumin levels, confusion, and fecal incontinence: are these risk factors for pressure ulcers in mobility-impaired hospitalized adults? Gerontology 2003;49(4)255-9	2,771 subjects that required high levels of nursing care were identified to have mobility impairment using a standard format. The subsequent development of stage 2 or greater PU was recorded for a maximum of 14 days after admission.406 patients (14.7%) subsequently developed at least one stage 2 or greater PU over a 2-week period.	Prospective Longitudinal cohort, multi-site controlled clinical trial. The data were collected at 47 Veterans Affairs Hospitals. Not blinded. Multivariate (stats?)	Study confirmed confusion (OR = 1.45) and low albumin (odds ratio OR = 1.40) as PU risk factors, but not fecal incontinence. A DNR order was found to be a new PU risk factor not previously described in the literature. (OR = 1.55) Two other known risk factors also entered the model: being malnourished (OR = 1.69) and requiring a urinary catheter (OR = 1.55). No p values.
Rees RS, Robson MC, Smeill JM and Perry BH. Becaplermin gel in the treatment of pressure ulcers: a phase II randomized, double-blind, placebo-controlled study. Wound Repair Regen 1999;7(3):144-7	124 patients with Stage II or IV PU treated daily with Placebo (n=31) or BBPDGF 100 ug/g (31) 300 ug/g (32) or 100 ug/g twice daily all in gauze dressings..	Double blind, RCT.. For 16 weeks. Measures were % 90 % healed in 16 weeks or % totally healed in 16 weeks. Safety was measured as adverse events.	23% of 100 ug/g daily healed in 16 weeks , 0% with placebo (p = 0.005); 19% of 300 ug/g daily healed (p = 0.008 vs placebo. Median ulcer volume was similarly reduced by these 2 PDGF treatmentsat the end of the study. P<0.025
Regan MA, Teasell RW, Wolfe DL, Keast D, Mortenson WB, Aubut JL, for the Spinal Cord Injury Rehabilitation Evidence Research Team. A systematic review of therapeutic interventions for pressure ulcers after spinal cord injury. Arch Phys Med Rehabil 2009;90:213-31.	26 Studies on patients with spinal cord injury (SCI) including 7 RCT on PU Treatment and 1 RCT on PU Prevention.	MEDLINE, EMBASE, CINAHL and PSYCHInfo databases were searched for PU prevention or treatment articles from 1980 to 2007 on 3 or more patients with SCI. PEDro method quality and modified Sackett evidence quality scales were used to summarize the data.	Prevention: Level 2 evidence supports early attendance of seating clinics and education, but PU incidence was not measured. Other modalities had level 4 evidence only. Treatment: Level 1 (≥ 2 RCT) evidence supported electrical stimulation, hydrocolloid dressings compared to gauze or phenytoin, pulsed electromagnetic fields. Also Level 1 that lasers don't work.
Reger SI, Ranganathan VK, Sahgal V. Support surface interface pressure, microenvironment, and the prevalence of pressure ulcers: an analysis of the literature. Ostomy Wound Manage. 2007 Oct;53(10):50-8.	Literature review of studies to 2007 (ordered)		

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Rennert R, Golinko M, Yan A, Flattau A, Tomic-Canic M, Brem, H. Developing and Evaluation Outcomes of an Evidence-based Protocol for the Treatment of Osteomyelitis in Stage IV Pressure Ulcers. Ostomy Wound Management. 2009;55(3):42-53.	Retrospective chart review of 177 hospitalized patients with at least 1 PU. Review of patients treated during years 2004-2007 at an inpatient/outpatient wound care center.	LR of more than 300 articles on osteomyelitis associated with a PU. A separate retrospective study of 177 patients using a wound electronic record review was used to develop an evidence-based protocol for PU osteomyelitis and to evaluate outcomes.	33% of patients with PU were diagnosed with osteomyelitis; 41 of the 50 patients underwent 87 bone debridements, 8 patients developed complications associated with treatment of the osteomyelitis. Complications included; C-Difficile infection, post-op hypotension/ anemia/ bleeding, BKA. Conclusions; Stage IV PU associated with increased risk of osteo, education patients/ families/ clinicians is critical to minimizing morbidity & mortality, use of EB treatment protocol is associated with improved outcomes. Team developed EB osteo treatment protocol with 7 essential steps; consider all stage IV PU suspect, clinical & lab assess for local/systemic signs infection on initial presentation, MRI/bone scan radiographic, surgical debride all nonviable/scarred/infected tissue & bone, bone culture & deep tissue culture pathology, targeted systemic antibiotic rx, tissue reconstruct after resolution of infection
Rich SE, Shardell M, Margolis D, Baumgarten M. Pressure ulcer preventive device use among elderly patients early in the hospital stay Nurs Res. 2009;58(2):95-104.	792 patients $\geq$ 65 years of age admitted to emergency departments of 2 Philadelphia PA hospitals between 1998 and 2001	Prospective cross-sectional cohort study. Research nurse examined patient by Day 3 post admission for preventive device use and risk and presence of PU plus patient record chart abstraction.	Only 15% of all patients and 51% of patients at PU risk (Norton Scale $\leq$ 14 had any preventive device in use at time of exam. High risk of PU was associated with use of preventive device. Only 68% of actual PU were documented.
Rhodes RS, Heyneman CA, Culbertson VL, Wilson SE, Phatak HM. Topical phenytoin treatment of stage II decubitus ulcers in the elderly. Ann Pharmacother. 2001 Jun;35(6):675-81.	47 nursing home patients with stage II pressure ulcers	RCT: 47 patients were randomly assigned to one of 3 groups; hydrocolloid, phenytoin or triple antibiotic dressing	Topical Phenytoin resulted in shorter time to complete healing than the HD or TAB groups (P < or = 0.05)

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Rithalia, S, the art and science of evaluating patient support surfaces. World Wide Wounds, Sept. 2001 www.worldwidewounds.com	Interface measurements, skin temperature and humidity testing. Limitations of testing methods	Literature review and expert opinion	There is a lack of quality data to support "engineering-based" criteria for evaluating support surfaces.
RNAO, Registered Nurses Association of Ontario; Risk Assessment & prevention of pressure ulcers, Mar 2005. www.rnao.org/bestpractices, accessed march 15, 2008.			
RNAO, Registered Nurses Association of Ontario; Assessment & Management of stage I to IV pressure ulcers, Mar 2007. www.rnao.org/bestpractices accessed March 30, 2008.			
Robson M. et al: Recombinant human PDGF-BB for the treatment of chronic pressure sores. Annals of plastic surgery. 1992; 29(3):193-201	20 patients with pressure sores treated for 28 days with 3 doses of PDGF	Double blind placebo controlled	The higher PDGF dose decreased the wounds volume in 21.8% compared to 6.4% in the placebo.
Rodeheaver GT, Ratliff CR. Wound cleansing, wound irrigation, wound disinfection. In: *Chronic Wound Care: A clinical Source Book for Healthcare Professionals.* 4th ed. Malvern PA: HMP Communications; 2007 pp 331-342.	Literature review of wound cleansing, disinfection and wound irrigation	Literature review with 1 CCT on PU. Dickman used a dental irrigation device set for 6 psi to irrigate PU on 8 patients twice / day for 2 weeks. 8 other patients with similar PU received standard care. Measure was % decrease in PU area	No significant difference in decrease in PU area. Study was underpowered to show significant difference with 51% reduction PU area of irrigated PU and 13% area reduction of controls.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Rosen, Jules MD; Mittal, Vikas PhD; Degenholtz, Howard PhD; Castle, Nick PhD; Mulsant, Benoit H. MD; Nace, David MD; Rubin, Fred H. MD. Pressure ulcer prevention in black and white nursing home residents:: a qi initiative of enhanced ability, incentives, and management feedback Advances in Skin & Wound Care, 2006;19(5):262-269.	12-week Baseline cohort in a 136-bed nursing home 12-week Staff Education Intervention cohort in the same nursing home). Three specific outcome measures were monitored (1) the rate of emergent Stage I-IV pressure ulcers identified, (2) the rate of emergent Stage II-IV pressure ulcers identified, and (3) the rate of individual residents developing at least 1 pressure ulcer (Stages II-IV).	Prospective cohort study. Subanalysis of a 3 yr longtitudinal study designed to monitor the emergence of all pressure ulcers in nursing home residents during 12-week baseline and intervention period educating nursing home staff about pressure ulcer prevention reduces the differential risk of pressure ulcer development (measured as PU incidence per 100 bed days) in black and white nursing home residents.	Black residents were more likely to have multiple Stage II-IV pressure ulcers and were less likely to have Stage I pressure ulcers identified at baseline compared with white residents. The education intervention effectively reduced the rate of pressure ulcers for all residents and eliminated the racial disparity noted during the baseline period. Believe higher incidence rate fro Blacks were due to difficulty in early detection. Study was limited in that is only included one facility and no control group.
Rosenthal MJ, Felton RM, Nastasi AE, Naliboff BD, Harker J, Navach JH. Healing of advanced pressure ulcers by a generic total contact seat: 2 randomized comparisons with low air loss bed treatments. *Arch Phys Med Rehabil*. 2003;84(12): 1733-1742.	207 subjects with Stage III or IV PU. Allocated randomly to LAL bed, upgraded overlay or 4 h per day on a generic alternating pressure total contact seat (APTCS) designed to distribute pressure.	Combined analysis of 2 randomized prospective cohort studies. Primary measures were healing time, number of ulcers healed during up to 6 months and Pressure Sore Status Tool (PSST) Scores after 4 weeks of treatment.	Overlay was not included in Study 2 after 3 patients worsened in this group compared to no patients in LAL and TCS. At 4 weeks, PSST scores were lowest for APTCS ($p < 0.01$). Mean healing times were 3.33 mo for APTCS , 4.38 mo for LAL, and 4.55 months for overlay ($p < 0.05$)
Russell, L Et al, Randomized comparison trial of the RIK and the Nimbus 3 mattresses. British Journal of Nursing, 2003, Vol 12, No 4, 254-259	Compare outcomes on the RIK (Fluid viscus mircobeads overlay) and the Nimbus 3 Mattress (multicell, alternating pressure system).	RCT – 75 patients on RIK, 83 on Nimbus completed the trial. 13 RIK patients transferred to Nimbus 3. Service issues with Nimbus 3 loss of 12 days of support surface time .	No statistical superiority was demonstrated. Lack of difference can be evidence of product superiority. Advantages if a static non-powered system – no electricity needed and no pump to service or noise issues
Sae-Sia W, Wipke-Tevis DD, Williams DA. Elevated sacral skin temperature (T(s)): a risk factor for pressure ulcer development in hospitalized neurologically impaired Thai patients. Appl Nurs Res. 2005;18(1):29-35.	Convenience cohort sample of 17 hospitalized neurologically impaired Thai patients.	Prospective cohort study measuring PU incidence within 2 weeks of admission and measured skin temperature (ST) as a predictors of PU development. Patients were positioned supine, then laterally.	47% developed a PU. Regardless of reclining position, mean ST of those who developed a PU was higher than those who did not ($P<0.01$) sacral ST was at least 1.2°C higher 24 to 96 h before a PU developed. ST may be an objective predictor of PU development in hospitalized neurologically impaired Thai patients.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Sae-Sia W, Wipke-Tevis DD, Williams DA. The effect of clinically relevant pressure duration on sacral skin blood flow and temperature in patients after acute spinal cord injury. Arch Phys Med Rehabil. 2007 Dec;88(12):1673-80.	Convenience sample of 20 subjects with acute spinal cord injury (SCI) within 24-96 h after injury;35 age- and sex-matched subjects with acute orthopedic trauma; 47 healthy subjects.	Prospective, repeated measures inception cohort study. Sacral skin temperature (ST) by thrmocouple and laser doppler flowmetry of skin blood flow (SBF) were measured at baseline and before and after 30 min of lying laterally (baseline no pressure), 2 h supine (pressure loading) and 90 m lateral lying (recovery no pressure)	ST elevated after 2 h pressure in all groups, with less increase in acute SCI patients than other 2 groups (p<0.001) SBF decreased more for SCI patients than other 2 groups during 2 h pressure loading. Baseline ST was higher in acute SCI patients. Reactive hyperemia occurred faster in acute SCI group than other 2 groups. SCI may need more frequent turning schedules.
Saladin LK, Krause JS. Pressure ulcer prevalence and barriers to treatment after spinal cord injury: comparisons of four groups based on race-ethnicity. NeuroRehabilitation. 2009;24(1):57-66	475 residents of 3 rehabilitation hospitals designated as a model SCI system of care by the US Dept of Education. 121 African Americans; 105 Amer. Indian,127 Caucasian, 122 Hispanics	Retrospective chart review and interview studying PU prevalence as a function of racial ethnic groups among spinal cord injured clients. Logistic regression determined odds of developing a PU within past 12 months.	Lowest PU prevalence occurred in Hispanic then Caucasian groups. African Americans and American Indians had higher odds of developing a PU in past 12 months. Low social support and high injury severity were also associated with PU risk
Salzberg CA et al. The effects of non-thermal pulsed electromagnetic energy on wound healing of pressure ulcers in spinal cord-injured patients: a randomized, double-blind study. Ostomy Wound Manage 1995;41(3):42-4	30 patients. Stage 2-3 pressure sores JT please provide N for each treatment group	Double blind, RCT. Pulsed electromagnetic energy 30 minutes twice a day for 12 weeks	Significantly increased rate of healing in the treatment group.
Samour, P. Quenn, Helen KK, Lang, CE Handbook of Pediatric nutrition, @nd Ed. Gaithersberg, MD: Aspen Publication,1999.	Pediatric albumin from Yale hospital system	Textbook References for pediatric nutrition: total protein, albumin and prealbumin	In order total protein, albumin, prealbumin Newborn: 4.4-7.6 , 3.2-4.8, 4-36 mg/dl 1-3 mos. 3.6-.4 2.1-4.8 13-27 3-12 mos. 4.2-7.5 2.8-5.7 1-12 years 3.7-7.9 3-2-5.1 12-28

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Sanada H, Moriguchi T, Miyachi Y, Ohura T, Nakajo T, Tokunaga K, Fukui M, Sugama, J, Kitagawa A. Reliability and validity of DESIGN, a tool that classifies pressure ulcer severity and monitors healing. J Wound Care. 2004;13(1):13-8.	8 photos of PU and 6 pressure ulcers rated by 7 nurses	DESIGN PU severity class tool ratings (including depth longest length and width, exudate, size, Infection, Granulation and Necrosis measurements) were validated against PSST ratings.	DESIGN inter-rater reliability correlated r=0.98 with photos and 0.91 for real-life patients with PU for all 7 raters' total scores. Validity r>0.91 between DESIGN and PSST scores for all 7 raters. DESIGN tool deemed good for quantitatively evaluating PU healing progress.
Sayag J. Semi-synthetic hydrocolloids in occlusive dressings for leg ulcers. In: T J Ryan (Ed) *Beyond occlusion: wound care proceedings*. Royal Society of Medicine Services Ltd., 1988;136:105-108	Hydrocolloid dressing (HCD) (626 total). Before applying dressing, wound was cleansed with 3% hydrogen peroxide for at least 1 minute, then rinsed with saline and dried with sterile gauze. Venous ulcers (356) Mixed arterio-venous (127) Arterial or diabetic (49) Trauma or burn (18) Neurotrophic foot ulcer (15) Pressure ulcer (7) Buerger's disease (1) Connective tissue disease (3); Lymphoedema (2); Sickle cell anemia (1)	Prospective HCT of HCD or other dressings on patients hospitalized with wounds (726 episodes) from 1981-1987 HCD was applied overlapping wound edges at least 3 cm and remained in place until detachment or up to 7 days. No other local treatment or form of debridement was used. No systemic antibiotics, corticosteroids, non-steroidal anti-inflammatory agents or hyperbaric oxygen was used. Prior prescribed anticoagulants or peripheral vasodilators were continued.	During the first 6 months of HCD use, complete healing occurred in 88% of wounds with initial diameter less than 2 cm and in 78% of those with diameter more than 4 cm. Total healing occurred in 89% of wounds enduring less than 6 months, 50% of those with longer duration. Healing was "shorter than that found with traditional dressings" and reduced length of hospital stays and costs of care.
Sayag J, Meaume S, Bohbot S. Healing properties of calcium alginate dressings. J Wound Care. 1996;5(8):357-62.	92 patients with full-thickness PU comparing alginate to dextranomer paste	Prospective 8-week RCT measuring median time to heal	Median healing time was 4 weeks with alginate, and more than 8 weeks with dextranomer paste (p = 0.0001)
Schubert V. Effects of phototherapy on pressure ulcer healing in elderly patients after afalling trauma. A prospective, randomized, controlled study. *Photodermatol Photoimmunol Photomed*. 2001;17(1):32-8.	Patients ≥ 65 years of age with a Stage 2 or 3 PU randomly assigned to standard PU therapy or the same + phototherapy pulsed monochromatic infrared (956 nm) and red (637 nm) pulse rep rate 15.6 to 8.58 Hz	Prospective non-blinded RCT of standard PU therapy vs same with monochromatic light 9 min daily for up to 10 weeks or until PU healed. Ulcer surface area was traced weekly.	Patients with monochromatic light had 49% higher healing rate and significantly shorter time to 50% and 90% PU closure compared to controls.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Scott EM, Baker EA, Kelly PJ, Stoddard EJ, Leaper DJ. Measurement of interface pressures in the evaluation of operating theatre mattresses. J Wound Care. 1999;8(9):437-41.	25 healthy volunteers recorded in each of 2 operating positions: supine and Lloyd-Davies on each of 4 pressure relief mattresses	Prospective RCT with all patients experiencing all levels of mattress and position in randomized order.	One mattress recorded lower interface pressure ($p \leq 0.05$) All interface pressures were influenced by body mass index. Lloyd-Davies position registered interface pressures 9.5% to 14.2% higher than supine position.
Seaman S, Shively M. Predictive validity of the Braden Scale in oncology and cardiac hospice patients: A pilot study. Proceedings of the 31st Wound Ostomy Continence Nursing Annual Conference, 2000, Salt Lake City, Utah.	Braden Scale [cut-off 16 compared with cut-off 19] (39 hospice patients: 29 oncology, 10 cardiac)	Prospective cohort study compared analyses of inter-rater reliability, % of patients correctly predicted, sensitivity, specificity, predictive value of a positive at risk score and of a negative (not at risk) score (a) including or (b) excluding patients who died during study.	Optimal Braden cut-off score was 16 for predicting PU in hospice patients. Predictive value and % of patients correctly identified as either at risk or not at risk of developing a PU were higher if patients who died were excluded from the analysis.
Seaman, S. Herbster S. Muglia J, Murray M, Rick C. Simplifying modern wound management for nonprofessional caregivers *Ostomy/Wound Management* 2000;46(8):18-27.	SignaDress (early form of DuoDERM® Signal) (17) versus Comfeel Plus (18)	Prospective study of healing and ease of teaching, ease of use of treatments on Stage II and III pressure ulcers in home care patients for 5 dressing changes or until healing occurred.	35% of SignaDress protocol wounds healed versus 6% of Comfeel Plus wounds ($p<0.04$). Both were rated high on ease of use and ease of teaching non-professional caregivers.
Schoonhoven L, Grobbee DE, Donders ART, Algra A, Grypdonck MH, Bausema MT, Schrijvers AJP, Buskend E, on behalf of the prePURSE Study Group. Prediction of pressure ulcer development in hospitalized patients: a tool for risk assessment. *Qual Saf Health Care* 2006; 15:65-70.	Among 1536 consecutive hospitalized patients admitted to 2 large Netherlands hospitals from January, 1999 to June 2000, 1431 who agreed to participate were enrolled. Complete follow-up data were available for 1229 (80%).	Prospective cohort study with patients followed once/week until PU occurred or patient was discharged from hospital or stay exceeded 12 weeks. Main outcome measured was occurrence of an EPUAP Grade 2 PU or worse during the hospital stay. PU ($p<0.10$) predictors were derived from logistic regression analysis. .A rule for PU prediction was developed assigning points for regression coefficient weights for each variable.	Over a total of 2025 patient weeks 121 patients developed a PU (incidence 0.06 per patient week). Age, weight at admission, abnormal appearance of skin, friction / shear, and planned surgery were independent PU predictors. For proposed cut-off point of 20, scale the % of patient weeks for which PU presence was accurately predicted = 70%; % accurately predicted PU absence = 39.7 % of patient weeks

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Shannon, M., Miller, B.M. Evaluation of hydrocolloid dressings on healing of pressure ulcers in spinal cord injury patients. *Decubitus* 1988;1(1):42 46.	DuoDERM (2) versus Gauze + A&D Ointment® (2)	Prospective study of healing and costs per week of treatments on matched pressure ulcers on spinal cord-injury patients hospitalized for 3 or 6 weeks.	Healing rates were similar, but there was less recurrence and lower costs per week with DuoDERM ($6.46 vs $18.46 for gauze.
Sheehan P, Jones P, Caselli A, Giurini J, Veves A. Percent change in wound area of diabetic foot ulcers over a 4-week period is a robust predictor of complete healing in a 12-week prospective trial. *Diabetes Care* 2003; 26(6): 1879-1882.			
Smith BM, Guihan M, LaVela SL, Garber SL. Factors predicting pressure ulcers in veterans with spinal cord injuries. Am J Phys Med Rehabil. 2008;87(9):750-7.	Survey of 2574 US Veterans in 2003, 36% of which reported having a PU during the previous year.	Multiple logistic regression to examine association between patient characteristics and self-report of having at least 1 PU.	Variables significantly associated with having at least 1 PU were: diabetes, smoking, injury duration >30 years and reporting frequent depressive symptoms.
Smitten A, Bolton L. Burden of pressure ulcer care. In Ayello E. Research Forum. *Advances in Skin & Wound Care* 2005; 18(4):192-193.	Standardized protocol of care including HCD D (all formats) as the main hydrocolloid and fibrous absorbent dressings with appropriate pressure relief (331 ulcers with dressings recorded)	Prospective cohort study of 295 patients with 821 Stage II-IV pressure ulcers from 3/2001- 12/2002 assessed by trained professionals using validated wound assessments. Measures included healing time, pain and infection.	Full-thickness PU healed in a mean of 55 days, partial-thickness, in 27 days (p<0.0001) Controlling for depth, mainly use of hydrocolloid and fiber primary dressings was associated with faster healing than gauze (p<0.02). > 20% area reduction in first 14 days of care predicted healing in 12 weeks.
Sopata M, Luczak J, Ciupinska M.Effect of bacteriological status on pressure ulcer healing in patients with advanced cancer. J Wound Care. 2002;11(3):107-10.	Lyofoam® (17 advanced cancer patients with Stage II or III pressure ulcers) Aquagel® Hydrogel Dressing (17 similar patients)	Prospective RCT measuring Infection, healing and treatment time qualitative, quantitative microbiology	No significant difference in any of the primary outcomes, qualitative or quantitative microbiology. No infections. Numbers or types of the 92 species of bacteria Identified did not correlate with dressing type, wound grade or outcomes.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Spilsbury K, Nelson A, Cullum N, Iglesias C, Nixon J, Mason S.Pressure ulcers and their treatment and effects on quality of life: hospital inpatient perspectives. J Adv Nurs. 2007; 57(5):494-504.	Cohort of 23 acute care inpatients with a Stage II-IV PU from 2002-4	Purposive sample of patients were given a standardized qualitative interview about impact of PU on their health and quality of life and levels of comfort with dressings and pressure relieving devices.	21 (91%) complained of pain, reporting that PU and its treatment reduced emotional, mental, physical and social aspects of quality of life. They felt that nurses did not acknowledge PU pain, discomfort and distress, increasing hospital stay. Author cites nurses' need to address patient needs and healing expectations.
Sprigle S, Linden M, McKenna D, Davis K, Riordan B. Clinical skin temperature measurement to predict incipient pressure ulcers. Adv Skin Wound Care. 2001;14(3):133-7.	65 inpatients and outpatients in an acute rehabilitation hospital presenting with pressure- induced erythema at areas at risk of PU development	Prospective cohort study. Skin temperature (ST) and appearance of 80 pairs of erythematic (reddened) and nearby control sites were documented. STs were considered equal if they differed less than $\pm 1^{\circ}$ F	15% (12) reddened sites were the same temperature as nearby control sites. 23% (18) reddened site were cooler than control sites. 63% 50) were warmer. Either increased or decreased temperature differences indicate reactive hyperemia or a Stage 1 PU.PU may exist with less than $\pm 1^{\circ}$ F ST difference.
Spungen AM, Koehler KM, Modeste-Duncan R, Rasul M, Cytryn AS, Bauman WA. 9 clinical cases of nonhealing pressure ulcers in patients with spinal cord injury treated with an anabolic agent: a therapeutic trial. Adv Skin Wound Care. 2001;14(3):139-44.	9 patients with history of >10% weight loss and non-healing full-thickness PU (Stage III or IV). 8 of these patients had non-healing PU of 2 months to 5 years duration. 1 was of 2 weeks duration.	All 9 patients were treated 1-2 months with oxandrolone 20 mg/day and glutamine 20 g/day.	8 healed completely in 3 to 12 months of treatment.
Sterzi, S, et al, Evaluation of prevalence and incidence of pressure ulcers and their relationship with mattresses used in a general hospital intensive care unit. Eur J Plastic Surg (2003) 25:401-404	95 patients – Standard mattress, Foam and Low Air Loss (LAL) mattress.	RCT – Randomized placement of patients on one of the three types of surfaces	Cumulative PU incidence and mattress type showed direct relationship. LAL mattresses were recommended

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Stotts NA, Rodeheaver GT, Thomas DR, Frantz RA, Bartolucci AA, Sussman C, Ferrell BA, Cuddigan J, Maklebust J. An instrument to measure healing in pressure ulcers: development and validation of the pressure ulcer scale for healing (PUSH). J Gerontol A Biol Sci Med Sci. 2001;56(12):M795-9.	Study 1: 103 patients Study 2: 269 All patients had at least 1 PU and were elderly mostly (51-70%) women	Retrospective cohort studies of data extracted from patient records. Principal components analysis analyzed % of variance in healing data explained by PUSH tool variables (length x width; exudate amount and tissue type). Multiple regression measured sensitivity of PUSH tool model to total healing.	PUSH tool accounted for 58-74% of wound healing variance at 10 weeks and 40-57% of wound healing variance at 12 weeks. Multiple regression showed it to account for 39% of variance in predicting healing at 6 weeks and 31% at 12 weeks.(These seem too low to be called good sensitivity). It is concluded that PUSH tool is sensitive and valid .
Stratford, RJ, Ek A-C, Engfer M, Moore Z, Rigby P, Wolfe R, Elia M. Enteral nutritional support in prevention and treatment of pressure ulcers: A systematic review and meta-analysis. Ageing Research Reviews. 2005 Volume 4, Issue 3, August, 422-450.	PU: incidence, healing, quality of life, complications, mortality, anthropometry and dietary intake were recorded, with the aim of comparing nutritional support versus routine care and nutritional formulas of different composition.	SR and MA of 15 studies, 5 RCTs comparing oral nutritional supplements (ONS) (4 RCTs) and enteral tube feeding (ETF) (1 RCT) with routine care could be included in a meta-analysis of pressure ulcer incidence.	ONS (had significantly lower incidence of PU in at-risk patients compared to routine care (odds ratio 0.75, 95% CI 0.62–0.89, 4 RCTs, *n* = 1224, elderly, post-surgical, chronically ospitalized patients). Results when a combined meta-analysis of ONS (4 RCT) and ETF (1 RCT) trials was performed (OR 0.74, 95% CI 0.62–0.88, 5 RCTs, *n* = 1325).
Strobel K, Stumpe KD. PET/CT in Musculoskeletal Infection. Seminars in Musculoskeletal Radiology. 2007 volume 11(4);353-364	76 articles inclusive of multifaceted musculoskeletal infections which may or may not directly include PU etiology were referenced by the authors	EO on imaging techniques used to identify, diagnose or screen for musculo-skeletal infection. The authors have co-authored several literature reviews on this subject.	Computerized tomography (CT) & Magnetic resonance imaging, used to evaluate musculoskeletal infection may be nonspecific for active infection vs post-op repair & are limited by metallic implant. PET (Fluorodeoxy-glucose-positron emission) tomography or PET/CT are sensitive & specific imaging techniques for early diagnosis of acute or chronic osteomyelitis. Prospective studies are needed to compare advantages and cost effectiveness.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Subbanna PK, Margaret Shanti FX, George J, Tharion G, Neelakantan N, Durai S, chandy SJ, Mathew BS, suresh R. Topical phenytoin solution for treating pressure ulcers: a prospective randomized, double-blind clinical trial. Spinal Cord, 2007 Nov;45(11):739-43.	28 spinal cord injury patients with stage II PU were randomized to either phenytoin or normal saline solution dressings daily for 15 days	RCT: Efficacy of phenytoin treatment determined by assessing the Pressure Ulcer Score for Healing (PUSH 3.0) on day 16	Results were statistically insignificant with the phenytoin group PUSH scores only marginally higher than normal saline group scores.
Suriadi, Sanada H, Sugama J, Kitagawa A, Thigpen B, Kinosita S, Murayama S. Risk factors in the development of pressure ulcers in an intensive care unit in Pontianak, Indonesia. Int Wound J. 2007;4(3):208-15.	105 adult patients in an ICU of an Indonesia hospital	Prospective cohort study with 35 patients of 105 developing a PU. Multivariate analysis identified significant risk factors for a PU developing	Final multivariate analysis identified interface pressure between skin and surface, skin moisture, smoking and body temperature elevation as significant risk factors for developing a PU
Taly AB, Sivaraman Nair KP, Murali T, John A. Efficacy of multiwavelength light therapy in the treament of pressure ulcers in subjects with disorders of the spinal cord: A randomized double-blind controlled trial. *Arch Phys Med Rehabil* 2004 Oct;85 (10):1657-61	Multiwavelength light therapy VS sham in the treament of pressure ulcers. Subjects; N=35 Pressure ulcers; N=64: 55 stage II, 8 stage III, 1 stage IV. Mean ulcer duration; treatment group =34.2 +/- 43.5, control group =57.1 +/-43.5days.	RCT double-blind study. Treatment consisted of 14 sessions/3 times a week; multiwavelength light therapy with 46 probes of different wavelengths from a gallium-aluminum-arsenide laser at 4.5 J/cm (2) versus sham system.	Multiwavelength light therapy from a gallium-aluminum-arsenide laser source did not influence overall healing of pressure ulcers. No significant difference in healing between the light and contol groups. Complete healing occurred in 18 ulcers in light group, 14 controls (P=.801) Mean healing times were light group 2.45 +/- 2.06 weeks versus 1.78 +/- 2.13 weeks in control group (P=.330). Healing time for stage III & IV to granulate to level similar the stage II was 2.25 +/- 0.5 weeks in light group versus 4.33 +/- 1.53 in control group (P=.047).
Tan SS, Kok SK, Lim JKY Efficacy of a new blister prevention plaster under tropical conditions. *Wilderness and Environmental Medicine 2008; 19:77-81.*	98 healthy military volunteers with Bursatek® Blistoban® held in place with mastisol (B) on 1 foot and control (C) foot 2-sock + talcum powder.	Prospective RCT using B on randomized and C on contralateral foot; reporting pre-hike foot condition and incidence of blister formation during a 16-km hike with pack	27 participants developed a total of 46 blisters, mainly on heel and/or toe. No B sies developed blisters. 99 of 101 applied B bandages adhered well to applied site. No blisters occurred over the other 2 sites.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Teot L. A multicentre randomised study of Aquacel versus a traditional dressing regime for the management of pressure sores. *Proceedings 6th European Conference on Advances in wound Management.* London, Macmillan Magazines, 1997	Pressure ulcers Stage II, III & IV Aquacel® Hydrofiber dressing (30) Vaseline gauze (28)	Prospective, randomized (stratified), controlled, multi-center/safety, effectiveness, wear time during 8 weeks of care in standardized protocol.	After 8 weeks, 27% of Hydrofiber® and 18% of gauze dressed wounds were healed. Mean wear times did not differ significantly. Five (5) wound-related and 35% of adverse events occurred in the Aquacel, and 14 in the gauze group.
Theilla M, Singer P, Cohen J, Dekeyser F. A diet enriched in eicosapentanoic acid, gamma-linolenic acid and antioxidants in the prevention of new pressure ulcer formation in critically ill patients with acute lung injury: A randomized, prospective, controlled study. Clinical nutrition.2007.26(6)752-7.	Occurrence and healing of PU in ICU pulmonary pts (100). Comparing 2 enteral formulas, a diet enriched in lipids (EPA, GLA) and vitamins (vitamins A, C and E) with a diet similar in macronutrient composition,.	Secondary outcome in a non blinded RCT was new PU incidence and healing of existing PU.	A significantly lower rate of occurrence of new pressure ulcers was observed in the study group compared to the control group (p<0.05). No difference was observed in the healing of existing pressure ulcers in the study as opposed to the control group. There was no significant difference in the nutritional parameters between the two groups.
Thomas DR, Diebold MR, Eggemeyer LM. A controlled, randomized, comparative study of a radiant heat bandage on the healing of stage 3-4 pressure ulcers: a pilot study. J Am Med Dir Assoc. 2005;6(1):46-9.	Hydrocolloid dressing with or without calcium alginate filler (~20 patients with Stage III or IV truncal PU > 1 cm^2) Radiant heat dressing device (~20 similar patients)	Prospective RCT pilot study measuring complete healing on study.	Similar percents of PU healed in both groups at almost all points along healing curve. No beneficial effect of radiant heat dressings.
Tippet AW. Reducing the incidence of pressure ulcers in nursing home residents: A prospective 6-year evaluation. *OWM* 2009; 55(11):52-58.	2002 Pre-protocol 3234 person months; Post protocol: 6446 person months.	Prospective CO study initiating a PU team with strong leader, intensive training, evidence-based protocols of PU prevention and carefully evaluated support surface and wound and skin care products.	Pre-protocol PU incidence was 5.19% (168 nursing-home-acquired PU in 3234 person months). Post-protocol: 0.73% (47 nursing home acquired PU in 6446 person months)
Tsukada, K., Tokunaga, K., Iwama, T., Mishima, Y. The pH Changes of Pressure Ulcers Related to the Healing Process of Wounds. *Wounds* 1992;4(1):16 20.	DuoDERM (8 pressure ulcers, and 3 venous ulcers)	Prospective open label study of wound and intact skin pH when dressed with DuoDERM®.	Intact skin ph remained low (5.5) in normal range when dressed with DuoDERM. pH of Stage I ulcer was 5.7 increased to 7.5 in Stage III.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Tudhope, M. Management of pressure ulcers with a hydrocolloid occlusive dressing: results in twenty three patients. *Journal of Enterostomal Therapy* 1984;11(3):102 105.	DuoDERM (23 patients with 30 pressure ulcers, 5 diabetic. 80% full-thickness)	Prospective open label study of healing and safety during 2 month treatment time or to healing.	47% of ulcers healed, 33% had marked improvement; one deteriorated. 4 of the 5 diabetic ulcers healed completely.
Ubbink, DT, Wweterbos J, Nelson EA, Vermeulen H. A systematic review of topical negative pressure therapy for acute and chronic wounds. Brit J Surg. 2008; 95: 685–692	Study 1: (Ford et al 2002) full-thickness PU VAC (20) ; Accuzyme, Iodosorb, Panafil (15) Study 2:(Wanner 2003) VAC (11) ; Ringers gauze (11)	Systematic review including 2 RCTs of VAC on PU. Study 1 Primary measure % healed in 6 weeks. Study 2 % with 50% reduction in volume during up to 56 days.	No statistically significant difference in healing in either of the two RCTs. Study 1: VAC healed 2/20; control: 2/15 Study 2: 50% reduced wound volume in 27 days (VAC) 28 days gauze.
Uzun O, Tan M. A prospective, descriptive pressure ulcer risk factor and prevalence study at a university hospital in Turkey. Ostomy Wound Manage. 2007;53(2):44-56.	344 patients admited to Turkish hospitals . 40 (11.6%) had at least one PU and 111 (32%) were found to be at risk of PU development as determined by Braden Scale	Prospective 1-day cross-sectional descriptive study to determine PU prevalence and risk factors associated with having a PU or being at Braden risk (<18).	Risk factors for having a PU: low serum albumin, other medical problems, patients who had surgery or were comatose. Factors with high Braden risk: male, older, unconscious, post surgery, BMI <18.5, serum albumin
van Rijswijk, L. Full Thickness Pressure Ulcers: Patient and Wound Healing Characteristics. *Decubitus* 1993;6(1):16 21.	DuoDERM and DuoDERM CGF (48 patients, 56 ulcers)	Retrospective analysis of prospective clinical studies on full-thickness pressure ulcers. All patients were studied for 2 months or until healing of their pressure ulcers, whichever came first.	37% of ulcers healed in a median of 56 days. 28% showed marked or moderate improvement. 47% reduction in pressure ulcer area during the first 2 weeks of care predicted healing.
van Rijswijk L, Polansky M. Predictors of time to heal deep pressure ulcers. *Wounds* 1994; 6(5):159-165.	48 patients with 56 Stage III or IV PU	Cohort study of factors present at patient baseline and after 2 weeks of treatment predicting wound healing. At 2 weeks, nutrition, age and % reduction in area were strong ($P \leq 0.2$) predictors.	Patients with good nutritional status healed in a median (mean) of 53(51) days. Those with poor nutritional status healed in 90 (73) days $p = 0.01$. Poor nutritional status and % area reduction after 2 weeks strongly predicted healing time.
Vanderwee, K et al, Alternating pressure air mattresses as prevention for pressure ulcers: A literature review. International Journal of Nursing Studies 45, (2008) 784-801	Systematic review of 35 studies. 15 RCTs found. 1 RT compared alternating pressure air mattress (APAM) to standard hospital (SH) mattress. Several RCTs compared APAM with low air loss mattresses (LAL)	Literature Review - Search for articles from PubMed, Cinahl, Central, Embase and Medline databases. 31, 20, 17, 0, and 29 articles (same order as list) were included for review plus 6 from reference lists. Main measure was PU incidence	1 RCT:"Alternating pressure air mattresses are likely to be more effective than" SH. 2 RCT showed APAM reduced PU incidence more than SH. No consistent difference between APM and LAL. Need for large studies. Need information on comfort issues. Nursing knowledge affects use of the devices

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Vesmarovich S, Walker T, Hauber RP, Temkin A, Burns R.Use of telerehabilitation to manage pressure ulcers in persons with spinal cord injuries. Adv Wound Care. 1999;12(5):264-9.	8 outpatients followed in rehabilitation center outpatient clinic	Weekly telerehabilitation assessments via Picasso Still-image Videophone to meet educational, vocational and social goals while treating PU	Pilot study demonstrated that PU can be successfully managed via telerehabilitation.
Wanner MB, Schwarzl F, Strub B, Zaech GA, Pierer G. Vacuum-assisted wound closure for cheaper and more comfortable healing of pressure sores: a prospective study. Scand J Plast Reconstr Surg Hand Surg. 2003;37(1):28-33.	Vacuum assisted closure (NPWT:11 inpatients with pelvic pressure ulcers) w/w or w/dry ringers saline soaked gauze changed 3 times daily (11)	Prospective RCT measuring time to reach 50% healing of PU (Stage not specified) and patient comfort and costs; granulation tissue formation	27 days to readh 50% healing in NPWT group and 28 days for gauze. NS difference in healing time or granulation, but reduced costs and improved comfort with NPWT. (Reviewer comment: gauze is substandard care. A moist healing comparator would be more relevant.)
Weng MH: The effect of protective treatment in reducing pressure ulcers for non-invasive ventilation patients. Intensive Crit Care Nurs. 2008; 24(5):295-9.	90 patients with face mask respirator in three groups: Control, Tegaderm and Tegasorb. Pressure sores were monitored.	Prospectrive Randomized controlled trial measured incidence of pressure ulcers developing while in critical care setting	The Tegaderm and Tegasorb groups had fewer pressure sores formation (P<0.01)
Whitney J, Phillips L, Aslam R, Barbul A, Gottrup F, Gould LI, Robson M, Rodeheaver G, Thomas D, Stotts N. Guidelines for the treatment of pressure ulcers. *Wound Repair Regeneration*, 2006;14:663-679.	Wound Healing Society Pressure ulcer treatment guideline.	Guideline	Published guideline not on the National Guideline Clearinghouse as of June, 2010.
Wild T, Stremitzer S, Budzanowski A, Hoelzenbein T, Ludwig C, Ohrenberger G.Definition of efficiency in vacuum therapy--a randomised controlled trial comparing with V.A.C. Therapy. Int Wound J. 2008;5(5):641-7	10 subjects with a PU , 5 in each group	RCT comparing V.A.C. NPWT to Redon drain bottle effects on absolute amount and % of wound that was granulation tissue, fibrin and necrosis, number of dressing changes and time invested in each system. Study was terminated after post hoc analysis showed better results using V.A.C.	Granulation tissue increased more and fibrin decreased more in NPWT group. No significant difference in necrosis. More time and effort taken with Redon drain bottle.
Wong TC and Ip FK: Comparison of gluteal fasciocutaneous rotational flaps and myocutaneous flaps for the treatment of sacral sores. Int Orthop 2006 Feb:30(1):64-7.	38 patients with sacral pressure sores. Comparing fasciocutaneous versus musculocutaneous flaps.	Retrospective convenience controlled study	Same healing rate and complication rate. Lower recurrent in the musculocutaneous flaps.

Reference	Study Groups (# of Subjects)	Study Design	Results (p<.0.05 if not specified)
Wood JM et al. A multicenter study on the use of pulsed low-intensity direct current for healing chronic stage II and stage III decubitus ulcers. Arch Dermatol. 1993;129(8):999-1009	74 patients with stage 2-3 pressure sores JT please provide N for each treatment group and study duration	Double blind, RCT. Pulsed low-intensity direct current.	58% healed versus 3% in the control P<0.0001
Xakellis, G., Chrischilles, E.A. Hydrocolloid versus saline gauze dressings in treating pressure ulcers: A cost effective analysis. *Arch. Phys Med Rehab.* 1992;73:463 469.	Hydrocolloid dressing (HCD: DuoDERM CGF 18) versus wet-to-moist gauze (21)	Prospective randomized parallel-group study of healing, skin condition cost of 6 months treatment.	Median time to healing 9 days for HCD vs 11 days for gauze (p<0.12). Less total cost to endpoint for HCD, which was statistically significant if figures used national nursing wages
Yamamoto T, Tsutsumida A, Murazumi M and Sugihara T: Long term outcome of pressure sores treated with flap coverage. Plast Reconstr Surg 1997 October:100(5):1212-7.	53 paraplegic patients with 69 pressure sores. Success rate was compared between different flaps.	Retrospective convenience controlled trial	Less recurrence with fasciocutaneous flaps compared to musculocutaneous flaps. P=0.015 (sacral) P=0.055 (ischial)
Zernike W. Preventing heel pressure sores: a comparison of heel pressure relieving devices. J Clin Nurs. 1994;3(6):375-80.	41 patients with fractured femurs randomly allocated to foam splints, eggshell foam, DuoDERM® or heel protector boots	Prospective RCT inspected heels daily over 12 days each patient measuring incidence of heel PU	Foam splints and eggshell foam were more effective than dressing or heel protector boots at preventing PU.

Additional References for Guidelines From Which AAWC Pressure Ulcer Guideline Steps Were Compiled

AHCPR Panel for the Prediction And Prevention Of Pressure Ulcers In Adults. Pressure ulcers in adults: Prediction and prevention. *Clinical Practice Guideline, No. 3.* Rockville, MD: U.S. Department of Health and Human Services. Public Health Service, Agency for Health Care Policy and Research. May, 1992. AHCPR Publication No. 92-0047.

Bergstrom N, Bennett MA, Carlson CE et al. *Treatment of Pressure Ulcers.* Clinical Practice Guideline, No. 15. Rockville, MD: U.S. Department of Health and Human Services. Public Health Service, Agency for Health Care Policy and Research. December, 1994. AHCPR Publication No. 95-0652.

The 13 Pressure Ulcer Guidelines from which PUCI Recommendations Were Derived
(Note: After first PUCI Guideline search Paralyzed Veterans of America Guideline merged with that of Consortium for Spinal Cord Medicine Guidelines)

1. RNAO, Registered Nurses Association of Ontario; Risk Assessment & prevention of pressure ulcers, Mar 2005. www.rnao.org/bestpractices, accessed march 15, 2008.
2. RNAO, Registered Nurses Association of Ontario; Assessment & Management of stage I to IV pressure ulcers, Mar 2007. www.rnao.org/bestpractices accessed March 30, 2008.
3. JHF, The John A. Hartford Foundation Institute for Geriatric Nursing; Pressure Ulcer Prevention, 2003
4. NCCNNS/NICE, National Collaborating Centre for Nursing and Supportive Care & National Institute for Clinical Excellence: Oct 2003
5. Paralyzed Veterans of America. Pressure ulcer prevention and treatment following spinal cord injury: A clinical practice guideline for health care professionals. Washington (DC): Paralyzed Veterans of America; 2000

Aug. Last accessed at www.guideline.gov on February 5, 2000.
6. Consortium for Spinal Cord Medicine Clinical Practice Guidelines Pressure ulcer prevention and treatment following spinal cord injury: a clinical practice guideline for health-care professionals. J Spinal Cord Med. 2001;24 Suppl 1:S40-101.
7. AMDA Pressure Ulcer Guidelines, National Guideline Clearinghouse, Last accessed January 31, 2009
8. AHCPR Pressure Ulcer Treatment Guidelines (Referenced as Bergstrom et al., 1994)
9. AHCPR Pressure Ulcer Prevention Guidelines (Referenced as AHCPR, 1992)
10. Wound, Ostomy, and Continence Nurses Society (WOCN). Guideline for prevention and management of pressure ulcers. Mount Laurel (NJ): Wound, Ostomy, and Continence Nurses Society (WOCN); 2010 Jun 1. 96 p. (WOCN clinical practice guideline; no. 2).
11. Wound Healing Society Pressure Ulcer Guideline (Referenced as Whitney et al., 2006)
12. NPUAP draft Pressure Ulcer Guidelines, in the Proceedings 11th National NPUAP Biennial Conference, Arlington, VA, February 27-28, 2009.
13. EPUAP draft Pressure Ulcer Guidelines reviewed online at http://www.epuap.org/ January-February 2009.