

Pressure Ulcer Risk Assessment and Prevention: A Comparative Effectiveness Review

Appendixes

Appendix A. Search Strategies

Overall

Database: EBM Reviews - Cochrane Database of Systematic Reviews

- 1 ((pressure or decubitus) and ulcer\$.ti,ab.
- 2 ((pressure or decubitus) and sore\$.ti,ab.
- 3 (bed sore\$ or bedsore\$.ti,ab.
- 4 or/1-3

Risk Assessment

Database: Ovid MEDLINE® and Ovid OLDMEDLINE®

- 1 Pressure Ulcer/
- 2 ((pressure or decubitus) and ulcer\$.mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 3 ((pressure or decubitus) and sore\$.mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 4 (bed sore\$ or bedsore\$.mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 5 or/1-4
- 6 Risk Assessment/
- 7 Risk Factors/
- 8 Nursing Assessment/
- 9 "Predictive Value of Tests"/
- 10 ROC Curve/
- 11 "Sensitivity and Specificity"/
- 12 "Reproducibility of Results"/
- 13 or/6-12
- 14 (risk adj2 (factor\$ or assess\$)).mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 15 13 or 14
- 16 5 and 15
- 17 "Severity of Illness Index"/
- 18 5 and 17
- 19 16 or 18
- 20 limit 19 to "all adult (19 plus years)"
- 21 limit 20 to humans

Database: EBM Reviews - Cochrane Central Register of Controlled Trials

- 1 Pressure Ulcer/
- 2 ((pressure or decubitus) and ulcer\$.mp. [mp=title, original title, abstract, mesh headings, heading words, keyword]
- 3 ((pressure or decubitus) and sore\$.mp. [mp=title, original title, abstract, mesh headings, heading words, keyword]
- 4 (bed sore\$ or bedsore\$.mp. [mp=title, original title, abstract, mesh headings, heading words, keyword]
- 5 or/1-4
- 6 Risk Assessment/
- 7 Risk Factors/
- 8 Nursing Assessment/
- 9 "Predictive Value of Tests"/
- 10 ROC Curve/
- 11 "Sensitivity and Specificity"/
- 12 "Reproducibility of Results"/

- 13 or/6-12
- 14 (risk adj2 (factor\$ or assess\$)).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword]
- 15 13 or 14
- 16 5 and 15
- 17 "Severity of Illness Index"/
- 18 5 and 17
- 19 16 or 18

Database: EBSCO CINAHL Plus®

- S1 (MH "Pressure Ulcer")
- S2 "pressure ulcer*"
- S3 "decubitus ulcer*"
- S4 "bedsore*"
- S5 "bed sore*"
- S6 S1 or S2 or S3 or S4 or S5
- S7 (MH "Risk Assessment") OR "risk assessment"
- S8 (MH "Risk Factors") OR "risk factors"
- S9 (MH "Nursing Assessment")
- S10 (MH "Predictive Value of Tests")
- S11 (MH "Sensitivity and Specificity")
- S12 (MH "Reproducibility of Results")
- S13 (MH "ROC Curve")
- S14 S7 or S8 or S9 or S10 or S11 or S12 or S13
- S15 "risk factor*"
- S16 "risk assess*"
- S17 S14 or S15 or S16
- S20 Limiters - Exclude MEDLINE records
- S19 Limiters - Age Groups: All Adult
- S18 S6 and S17
- S21 S18 and S19
- S22 S18 and S20
- S23 S21 and S22

Risk Assessment – Prognosis

Database: Ovid MEDLINE® and Ovid OLDMEDLINE®

- 1 Pressure Ulcer/
- 2 ((pressure or decubitus) and ulcer\$).mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 3 ((pressure or decubitus) and sore\$).mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 4 (bed sore\$ or bedsore\$).mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 5 or/1-4
- 6 Risk Assessment/
- 7 Risk Factors/
- 8 Nursing Assessment/
- 9 "Predictive Value of Tests"/
- 10 ROC Curve/
- 11 "Sensitivity and Specificity"/
- 12 "Reproducibility of Results"/
- 13 or/6-12
- 14 (risk adj2 (factor\$ or assess\$)).mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 15 13 or 14

- 16 5 and 15
- 17 "Severity of Illness Index"/
- 18 5 and 17
- 19 16 or 18
- 20 limit 19 to "all adult (19 plus years)"
- 21 limit 20 to humans
- 22 Prognosis/
- 23 16 and 22
- 24 limit 23 to "all adult (19 plus years)"

Prevention

Database: Ovid MEDLINE® and Ovid OLDMEDLINE®

- 1 Pressure Ulcer/
- 2 ((pressure or decubitus) and ulcer\$.mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 3 ((pressure or decubitus) and sore\$.mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 4 (bed sore\$ or bedsore\$.mp. [mp=protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier]
- 5 or/1-4
- 6 5 and pc.fs.
- 7 5 and prevent\$.mp.
- 8 6 or 7
- 9 limit 8 to "all adult (19 plus years)"
- 10 limit 9 to humans

Database: EBM Reviews - Cochrane Central Register of Controlled Trials

- 1 Pressure Ulcer/
- 2 ((pressure or decubitus) and ulcer\$.mp. [mp=title, original title, abstract, mesh headings, heading words, keyword]
- 3 ((pressure or decubitus) and sore\$.mp. [mp=title, original title, abstract, mesh headings, heading words, keyword]
- 4 (bed sore\$ or bedsore\$.mp. [mp=title, original title, abstract, mesh headings, heading words, keyword]
- 5 or/1-4
- 6 5 and pc.fs.
- 7 5 and prevent\$.mp.
- 8 6 or 7

Database: EBSCO CINAHL Plus®

- S1 (MH "Pressure Ulcer")
- S2 "pressure ulcer*"
- S3 "decubitus ulcer*"
- S4 "bedsore*"
- S5 "bed sore*"
- S6 S1 or S2 or S3 or S4 or S5
- S7 "prevent*"
- S8 S6 and S7
- S9 S6 and S7 Limiters - Exclude MEDLINE records
- S10 S6 and S7 Limiters - Age Groups: All Adult

Appendix B. Inclusion and Exclusion Criteria by Key Question

	Include	Exclude
KQ 1		
Population	All adult patients, ages ≥ 18 years old in the following settings: acute care hospital, long-term care facility, rehabilitation facility, operating room, home care, and wheelchair users in the community	Children and adolescents
Patient characteristics	Such as age, race or skin tone, physical impairment, body weight, specific medical comorbidities (e.g., diabetes, peripheral vascular disease)	Baseline pressure ulcers (>10%)
Interventions	Pressure ulcer risk-assessment tools, including Braden Scale, Norton Scale, Waterlow Scale, other tools	Individual predictors/risk factors
Comparators	Clinical judgment and/or usual care Different risk-assessment tools and reference standard	
Outcomes	Incidence of pressure ulcers, further examining effects of setting and patient characteristics on incidence Severity/stage of pressure ulcers, further examining effects of setting and patient characteristics on severity/stage Resource utilization (e.g., length of stay, number of hospitalizations)	
Settings	Acute care hospital, long-term care facility, rehabilitation facility, operating room, home care, and wheelchair users in the community	
Study designs	Controlled or comparative randomized and nonrandomized trials and controlled or comparative observational studies	
KQ 2		
Population	All adult patients, ages ≥ 18 years old in the following settings: acute care hospital, long-term care facility, rehabilitation facility, operating room, home care, and wheelchair users in the community	Children and adolescents
Patient characteristics	Such as age, race or skin tone, physical impairment, body weight, specific medical comorbidities (e.g., diabetes, peripheral vascular disease)	Baseline pressure ulcers (>10%)
Interventions	Pressure ulcer risk-assessment tools, including Braden Scale, Norton Scale, Waterlow Scale, other tools	Individual predictors/risk factors
Comparators	Different risk-assessment tools and reference standard	
Outcomes	Predictive validity of tools, further examining effects of setting and patient characteristics on predictive validity. E.g., diagnostic accuracy = sensitivity, specificity, positive and negative likelihood ratios, positive and negative predictive values; measures of risk = HR, OR, RR; calibration; discrimination = area under receiver operating characteristic (ROC) curve, etc.	Inter-rater reliability
Settings	Acute care hospital, long-term care facility, rehabilitation facility, operating room, home care, and wheelchair users in the community	
Study designs	Studies of predictive validity; Prospective studies	Retrospective studies; Case-control studies
KQ 3		
Population	Adult patients, ages ≥ 18 years old	Children and adolescents
Patient characteristics	Such as age, race or skin tone, physical impairment, body weight, specific medical comorbidities (e.g., diabetes, peripheral vascular disease)	Baseline pressure ulcers (>10%)
Interventions	Interventions to prevent pressure ulcers: Support surfaces (e.g., beds, overlays for mattresses), Dressings, Nutritional support, Nursing interventions (e.g., turning, repositioning), Self-care education, Wheelchair features, Combined treatment modalities	Non-preventive treatment interventions (covered in a separate review) Nursing education
Comparators	Usual care, placebo, no treatment, different preventive interventions (including different preventive interventions within the same category; e.g., alternating pressure mattress vs. foam overlay)	
Outcomes	Incidence of pressure ulcers, further examining effects of risk level, setting, and patient characteristics on incidence Severity/stage of pressure ulcers, further examining effects of risk level, setting, and patient characteristics on severity/stage Resource utilization (e.g., length of stay, number of hospitalizations) More specific measures of comfort: sleep deprivation, quality of life, etc.	Comfort
Settings	Acute care hospital, long-term care facility, rehabilitation facility, operating room,	

	Include	Exclude
	home care, and wheelchair users in the community	
Study designs	Focus on RCTs, and if needed, large cohort studies.	Small observational studies
KQ 4		
Population	Adult patients, ages ≥ 18 years old	Children and adolescents
Patient characteristics	Such as age, race or skin tone, physical impairment, body weight, specific medical comorbidities (e.g., diabetes, peripheral vascular disease)	Baseline pressure ulcers (>10%)
Interventions	Interventions to prevent pressure ulcers: Support surfaces (e.g., beds, overlays for mattresses), Dressings, Nutritional support, Nursing interventions (e.g., turning, repositioning), Self-care education, Wheelchair features, Combined treatment modalities	Non-preventive treatment interventions (covered in a separate review)
Comparators	Usual care, placebo, no treatment, different preventive interventions (including different preventive interventions within the same category; e.g., alternating pressure mattress vs. foam overlay)	
Outcomes	Harms of preventive interventions/strategies, such as dermatologic reactions, pain, or infection, further examining effects of categories of impairment, setting, and patient characteristics	
Settings	Acute care hospital, long-term care facility, rehabilitation facility, operating room, home care, and wheelchair users in the community	
Study designs	Randomized controlled trials, cohort studies, and other observational studies.	

Appendix C. Included Studies List

Andersen KE, Jensen O, Kvorning SA, Bach E. Decubitus prophylaxis: a prospective trial on the efficiency of alternating-pressure air-mattresses and water-mattresses. *Acta dermato-venereologica*. 1982;63(3):227-30. PMID: 6192636

Andersen KE, Jensen O, Kvorning SA, Bach E. Prevention of pressure sores by identifying patients at risk. *Br Med J (Clin Res Ed)*. 1982 May 8;284(6326):1370-1. PMID: 6803980

Aronovitch SA, Wilber M, Slezak S, Martin T, Utter D. A comparative study of an alternating air mattress for the prevention of pressure ulcers in surgical patients. *Ostomy/wound management*. 1999 1999 Mar;45(3):34-40. PMID: 10347518

Baldwin KM, Ziegler SM. Pressure ulcer risk following critical traumatic injury. *Adv Wound Care*. 1998 Jul-Aug;11(4):168-73. PMID: 10326336

Bale S, Finlay I, Harding KG. Pressure sore prevention in a hospice. *Journal of wound care*. 1995 Nov;4(10):465-8. PMID: 8548573

Barnes D, Payton RG. Clinical application of the Braden Scale in the acute-care setting. *Dermatol Nurs*. 1993 Oct;5(5):386-8. PMID: 8274348

Barton AA, Barton M. Drug-based prevention of pressure-sores. *Lancet*. 1976 Aug;2(7983):443-4. PMID: 73744

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. *Nursing Research*. 1998 Sep-Oct;47(5):261-9. PMID: 9766454

Bergstrom N, Braden B, Laguzza A. The Braden Scale for predicting pressure sore risk. *Nursing Research*. 1987a(36):205-10. PMID: 3299278

Bergstrom N, Braden B. A prospective study of pressure sore risk among institutionalized elderly. *Journal of the American Geriatrics Society*. 1992 Aug;40(8):747-58. PMID: 1634717

Bergstrom N, Braden BJ. Predictive validity of the Braden Scale among Black and White subjects. *Nursing Research*. 2002 Nov-Dec;51(6):398-403. PMID: 12464760

Bergstrom N, Demuth PJ, Braden BJ. A clinical trial of the Braden Scale for Predicting Pressure Sore Risk. *Nurs Clin North Am*. 1987b Jun;22(2):417-28. PMID: 3554150

Berthe JV, Bustillo A, Melot C, de Fontaine S. Does a foamy-block mattress system prevent pressure sores ? A prospective randomised clinical trial in 1729 patients. *Acta chirurgica Belgica*. 2007 Mar-Apr;107(2):155-61. PMID: 17515264

Bourdel-Marchasson I, Barateau M, Rondeau V, Dequae-Merchadou L, Salles-Montaudon N, Emeriau JP, et al. A multi-center trial of the effects of oral nutritional supplementation in critically ill older inpatients. *Nutrition*. 2000;16(1):1-5. PMID: 10674226

Boyle M, Green M. Pressure sores in intensive care: defining their incidence and associated factors and assessing the utility of two pressure sore risk assessment tools. *Aust Crit Care*. 2001 Feb;14(1):24-30. PMID: 11899757

Braden BJ, Bergstrom N. Predictive validity of the Braden Scale for pressure sore risk in a nursing home population. *Research in nursing & health*. 1994 Dec;17(6):459-70. PMID: 7972924

Brienza D, Kelsey S, Karg P, Allegretti A, Olson M, Schmeler M, et al. A randomized clinical trial on preventing pressure ulcers with wheelchair seat cushions. *J Am Geriatr Soc*. 2010 Dec;58(12):2308-14. PMID: 3065866

Capobianco ML, McDonald DD. Factors affecting the predictive validity of the Braden Scale. *Adv Wound Care*. 1996 Nov-Dec;9(6):32-6. PMID: 9069754

Chan EY, Tan SL, Lee CKS, Lee JY. Prevalence, incidence and predictors of pressure ulcers in a tertiary hospital in Singapore. *Journal of wound care*. 2005 Sep;14(8):383-4, 6-8. PMID: 16178294

Chan WS, Pang SMC, Kwong EWY. Assessing predictive validity of the modified Braden scale for prediction of pressure ulcer risk of orthopaedic patients in an acute care setting. *Journal of Clinical Nursing*. 2009 Jun;18(11):1565-73. PMID: 19490294

Collier ME. Pressure-reducing mattresses. *Journal of wound care*. 1996 May;5(5):207-11. PMID: 8850903

Compton F, Hoffmann F, Hortig T, Strauss M, Frey J, Zidek W, et al. Pressure ulcer predictors in ICU patients: nursing skin assessment versus objective parameters.[Erratum appears in *J Wound Care*. 2008 Nov;17(11):493]. *Journal of wound care*. 2008 Oct;17(10):417-20, 22-4. PMID: 18947019

Conine TA, Daechsel D, Hershler C. Pressure sore prophylaxis in elderly patients using slab foam or customized contoured foam wheelchair cushions. *Occup Ther J Res*. 1993;13(2):101-16

Conine TA, Daechsel D, Lau MS. The role of alternating air and Silicore overlays in preventing decubitus ulcers. *International journal of rehabilitation research*. 1990;Internationale Zeitschrift fur Rehabilitationsforschung. *Revue internationale de recherches de readaptation*. 13(1):57-65. PMID: 2394540

Conine TA, Hershler C, Daechsel D, Peel C, Pearson A. Pressure ulcer prophylaxis in elderly patients using polyurethane foam or Jay wheelchair cushions. *International journal of rehabilitation research*. 1994 Jun;17(2):123-37. PMID: 7960335

Cooper P, Gray D. Comparison of two skin care regimes for incontinence. *British journal of nursing (Mark Allen Publishing)*. 2001 S10 passim, 2001 Mar;10(6 Suppl):S6, S8, S10 passim. PMID: 12070396

Cooper PJ, Gray DG, Mollison J. A randomised controlled trial of two pressure-reducing surfaces. *Journal of wound care*. 1998 Sep;7(8):374-6. PMID: 9832744

Daechsel D, Conine TA. Special mattresses: effectiveness in preventing decubitus ulcers in chronic neurologic patients. *Archives of physical medicine and rehabilitation*. 1985 Apr;66(4):246-8. PMID: 3985778

Declair V. The usefulness of topical application of essential fatty acids (EFA) to prevent pressure ulcers. *Ostomy/wound management*. 1997 Jun;43(5):48-52. PMID: 9233238

Defloor T, De Bacquer D, Grypdonck MHF. The effect of various combinations of turning and pressure reducing devices on the incidence of pressure ulcers. *International journal of nursing studies*. 2005 Jan;42(1):37-46. PMID: 15582638

Defloor T, Grypdonck MF. Pressure ulcers: validation of two risk assessment scales. *Journal of clinical nursing*. 2005 Mar;14(3):373-82. PMID: 15707448

Delmi M, Rapin CH, Bengoa JM, Bonjour JP, Vasey H, Delmas PD. Dietary supplementation in elderly patients with fractured neck of the femur. *The Lancet*. 1990;335(8696):1013-6. PMID: 1970070

Donnelly J, Winder J, Kernohan WG, Stevenson M. An RCT to determine the effect of a heel elevation device in pressure ulcer prevention post-hip fracture. *Journal of wound care*. 2011 Jul;20(7):309-12, 14-8. PMID: 21841719

Duimel-Peeters IG, R JGH, Ambergen AW, Houwing RH, M PFB, Snoeckx LH. The effectiveness of massage with and without dimethyl sulfoxide in preventing pressure ulcers: a randomized, double-blind cross-over trial in patients prone to pressure ulcers. *International journal of nursing studies*. 2007 Nov;44(8):1285-95. PMID: 17553503

Edwards M. The levels of reliability and validity of the Waterlow pressure sore risk calculator. *Journal of wound care*. 1995 Sep;4(8):373-8. PMID: 7553188

Fader M, Clarke-O'Neill S, Cook D, Dean G, Brooks R, Cottenden A, et al. Management of night-time urinary incontinence in residential settings for older people: an investigation into the effects of different pad changing regimes on skin health. *Journal of clinical nursing*. 2003 May;12(3):374-86. PMID: 12709112

Feuchtinger J, de Bie R, Dassen T, Halfens R. A 4-cm thermoactive viscoelastic foam pad on the operating room table to prevent pressure ulcer during cardiac surgery. *J Clin Nurs*. 2006 Feb;15(2):162-7. PMID: 16422733

Feuchtinger J, Halfens R, Dassen T. Pressure ulcer risk assessment immediately after cardiac surgery--does it make a difference? A comparison of three pressure ulcer risk assessment instruments within a cardiac surgery population. *Nurs Crit Care*. 2007 Jan-Feb;12(1):42-9. PMID: 17883663

Gebhardt KS, Bliss MR, Winwright PL, Thomas J. Pressure-relieving supports in an ICU. *Journal of wound care*. 1996 Mar;5(3):116-21. PMID: 8826270

Geyer MJ, Brienza DM, Karg P, Trefler E, Kelsey S. A randomized control trial to evaluate pressure-reducing seat cushions for elderly wheelchair users. *Adv Skin Wound Care*. 2001 May-Jun;14(3):120-9; quiz 31-2. PMID: 11905977

Goldstone LA, Norris M, O'Reilly M, White J. A clinical trial of a bead bed system for the prevention of pressure sores in elderly orthopaedic patients. *Journal of advanced nursing*. 1982;7(6):545-8. PMID: 6759553

Goodridge DM, Sloan JA, LeDoyen YM, McKenzie J, Knight WE, Gayari M. Risk-assessment scores, prevention strategies, and the incidence of pressure ulcers among the elderly in four Canadian health-care facilities. *Can J Nurs Res*. 1998;30(2):23-44. PMID: 9807287

Gray DG, Smith M. Comparison of a new foam mattress with the standard hospital mattress. *Journal of wound care*. 2000 Jan;9(1):29-31. PMID: 10827665

Gray DG. A randomized clinical trial of two types of foam mattresses. *Journal of Tissue Viability*. 1994(4):128-32

Gunningberg L, Lindholm C, Carlsson M, Sjoden PO. Effect of visco-elastic foam mattresses on the development of pressure ulcers in patients with hip fractures. *Journal of wound care*. 2000 Nov;9(10):455-60. PMID: 11933449

Hagisawa S, Barbenel J. The limits of pressure sore prevention. *J R Soc Med*. 1999 Nov;92(11):576-8. PMID: 1297433

Halfens RJ, Van Achterberg T, Bal RM. Validity and reliability of the braden scale and the influence of other risk factors: a multi-centre prospective study. *International journal of nursing studies*. 2000 Aug;37(4):313-9. PMID: 10760538

Hatanaka N, Yamamoto Y, Ichihara K, Mastuo S, Nakamura Y, Watanabe M, et al. A new predictive indicator for development of pressure ulcers in bedridden patients based on common laboratory tests results. *Journal of clinical pathology*. 2008 Apr;61(4):514-8. PMID: 18375746

Hofman A, Geelkerken RH, Wille J, Hamming JJ, Hermans J, Breslau PJ. Pressure sores and pressure-decreasing mattresses: controlled clinical trial. *Lancet*. 1994 Mar;343(8897):568-71. PMID: 7906329

Hoshowsky VM, Schramm CA. Intraoperative pressure sore prevention: an analysis of bedding materials. *Research in nursing & health*. 1994 Oct;17(5):333-9. PMID: 8090944

Houwing R, van Asbeck S, Halfens R, Arends JW. An unexpected detrimental effect on the incidence of heel pressure ulcers after local 5% DMSO cream application: a randomized, double-blind study in patients at risk for pressure ulcers. *Wounds: A Compendium of Clinical Research & Practice*. 2008;20(4):84-8

Houwing RH, Rozendaal M, Wouters-Wesseling W, Beulens JW, Buskens E, Haalboom JR. A randomised, double-blind assessment of the effect of nutritional supplementation on the prevention of pressure ulcers in hip-fracture patients. *Clinical nutrition (Edinburgh, Scotland)*. 2003 Aug;22(4):401-5. PMID: 12880608

Inman KJ, Sibbald WJ, Rutledge FS, Clark BJ. Clinical utility and cost-effectiveness of an air suspension bed in the prevention of pressure ulcers. *Jama*. 1993 Mar 3;269(9):1139-43. PMID: 8433469

Jalali R, Rezaie M. Predicting pressure ulcer risk: comparing the predictive validity of 4 scales. *Advances in Skin & Wound Care*. 2005 Mar;18(2):92-7. PMID: 15788914

Jesurum J, Joseph K, Davis JM, Suki R. Balloons, beds, and breakdown. Effects of low-air loss therapy on the development of pressure ulcers in cardiovascular surgical patients with intra-aortic balloon pump support. *Critical care nursing clinics of North America*. 1996 Dec;8(4):423-40. PMID: 9095813

Jolley DJ, Wright R, McGowan S, Hickey MB, Campbell DA, Sinclair RD, et al. Preventing pressure ulcers with the Australian Medical Sheepskin: an open-label randomised controlled trial. *Med J Aust*. 2004 Apr 5;180(7):324-7. PMID: 15059051

Kemp MG, Kopanke D, Tordecilla L, Fogg L, Shott S, Matthiesen V, et al. The role of support surfaces and patient attributes in preventing pressure ulcers in elderly patients. *Research in nursing & health*. 1993 Apr;16(2):89-96. PMID: 8502770

Kim E, Lee S, Lee E, Eom M. Comparison of the predictive validity among pressure ulcer risk assessment scales for surgical ICU patients. *Aust J Adv Nurs*. 2009;26(4):87-94

Kwong E, Pang S, Wong T, Ho J, Shao-ling X, Li-jun T. Predicting pressure ulcer risk with the modified Braden, Braden, and Norton scales in acute care hospitals in Mainland China. *Appl Nurs Res*. 2005 May;18(2):122-8. PMID: 15991112

Langemo DK, Olson B, Hunter S, Hanson D, Burd C, Cathcart-Silberberg T. Incidence and prediction of pressure ulcers in five patient care settings. *Decubitus*. 1991 Aug;4(3):25-6, 8, 30 passim. PMID: 1872975

Lewicki LJ, Mion LC, Secic M. Sensitivity and specificity of the Braden Scale in the cardiac surgical population. *Journal of Wound, Ostomy, & Continence Nursing*. 2000 Jan;27(1):36-41. PMID: 10649141

Lim R, Sirett R, Conine TA, Daechsel D. Clinical trial of foam cushions in the prevention of decubitus ulcers in elderly patients. *Journal of rehabilitation research and development*. 1988;25(2):19-26. PMID: 3361457

Lincoln R, Roberts R, Maddox A, Levine S, Patterson C. Use of the Norton Pressure Sore Risk Assessment Scoring System with elderly patients in acute care. *J Enterostomal Ther*. 1986 Jul-Aug;13(4):132-8. PMID: 3636346

Lindgren M, Unosson M, Krantz A, Ek A. A risk assessment scale for the prediction of pressure sore development: reliability and validity. *Journal of Advanced Nursing*. 2002;38(2):190-9. PMID: 11940132

Lyder CH, Yu C, Emerling J, Mangat R, Stevenson D, Empleo-Frazier O, et al. The Braden Scale for pressure ulcer risk: evaluating the predictive validity in Black and Latino/Hispanic elders. *Appl Nurs Res*. 1999 May;12(2):60-8. PMID: 10319520

Lyder CH, Yu C, Stevenson D, Mangat R, Empleo-Frazier O, Emerling J, et al. Validating the Braden Scale for the prediction of pressure ulcer risk in blacks and Latino/Hispanic elders: a pilot study. *Ostomy Wound Management*. 1998 Mar;44(3A Suppl):42S-9S; discussion 50S. PMID: 9625997

McGowan S, Montgomery K, Jolley D, Wright R. The role of sheepskins in preventing pressure ulcers in elderly orthopaedic patients. *First World Wound Healing Congress*. 2000

Mistiaen P, Achterberg W, Ament A, Halfens R, Huizinga J, Montgomery K, et al. The effectiveness of the Australian Medical Sheepskin for the prevention of pressure ulcers in somatic nursing home patients: a prospective multicenter randomized-controlled trial (ISRCTN17553857). *Wound repair and regeneration* : official publication of the Wound Healing Society [and] the European Tissue Repair Society. 2010 Nov-Dec;18(6):572-9. PMID: 20946141

Moore Z, Cowman S, Conroy RM. A randomised controlled clinical trial of repositioning, using the 30° tilt, for the prevention of pressure ulcers. *Journal of Clinical Nursing*. 2011;20(17/18):2633-44. PMID: 21702861

Nakagami G, Sanada H, Konya C, Kitagawa A, Tadaka E, Matsuyama Y. Evaluation of a new pressure ulcer preventive dressing containing ceramide 2 with low frictional outer layer. *Journal of advanced nursing*. 2007 Sep;59(5):520-9. PMID: 17681081

Nixon J, McElvenny D, Mason S, Brown J, Bond S. A sequential randomised controlled trial comparing a dry visco-elastic polymer pad and standard operating table mattress in the prevention of post-operative pressure sores. *Int J Nurs Stud*. 1998 Aug;35(4):193-203. PMID: 9801935

Olson K, Tkachuk L, Hanson J. Preventing pressure sores in oncology patients. *Clin Nurs Res*. 1998 May;7(2):207-24. PMID: 9633340

Page KN, Barker AL, Kamar J. Development and validation of a pressure ulcer risk assessment tool for acute hospital patients. *Wound Repair Regen*. 2011 Jan;19(1):31-7. PMID: 21134037

Pang S, Wong T. Predicting pressure sore risk with the Norton, Braden, and Waterlow scales in a Hong Kong rehabilitation hospital. *Nursing Research*. 1998;47:147-53. PMID: 9610648

Perneger TV, Rae AC, Gaspoz JM, Borst F, Vitek O, Heliot C. Screening for pressure ulcer risk in an acute care hospital: development of a brief bedside scale. *J Clin Epidemiol*. 2002 May;55(5):498-504. PMID: 12007553

Pring J, Millman P. Evaluating pressure-relieving mattresses. *Journal of Wound Care*. 1998;7(4):177-9. PMID: 9644426

Ramundo JM. Reliability and validity of the Braden Scale in the home care setting. *Journal of Wound, Ostomy, & Continence Nursing*. 1995 May;22(3):128-34. PMID: 7599722

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Wrong Study Design for Key Question

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Appendix E. Non-English Language Titles and Abstracts

Titles Only

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Matsui, Y., S. Miyake, et al. (2001). "Randomized controlled trial of a two layer type air cell mattress in the prevention of pressure ulcers." Japanese Journal of Pressure Ulcers **3**(3): 331-337.

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Torra i Bou, J., T. Segovia Gomez, et al. (2005). "Efficiency of a hyperoxygenated fatty acid compound in the prevention of pressure ulcers [Spanish]." Gerokomos **16**(4): 229-236.

Titles and Abstracts

Blumel, J. E., K. Tirado, et al. (2004). "[Prediction of the pressure ulcer development in elderly women using the Braden scale]." Revista Medica de Chile **132**(5): 595-600.

BACKGROUND: Pressure ulcers are a common complication among elderly patients confined to bed for long periods. The Braden scale is a commonly used risk assessment tool. AIM: To evaluate the use of Braden scale. PATIENTS AND METHODS: Seventy women aged 61 to 96 years, admitted to the Internal Medicine Service of Barros Luco-Trudeau Hospital, were studied. Their risk was evaluated using the Braden scale. The presence of pressure ulcer was diagnosed according to the National Pressure Ulcer Advisory Panel on admission, two weeks later and at discharge. RESULTS: On admission, mean Braden scale score was 16.6+/-2.8 and 34 women had a score of 16 or less, that is considered of risk. Twenty five women (20 with a score of 16 or less) developed pressure ulcers, mostly superficial. The odds ratio of a score of 16 or less for the development of ulcers was 4.2 (95% CI 1.8-11.7, p <0.001). The sensitivity and specificity of such score were 80 and 69% respectively. CONCLUSIONS: The Braden scale predicts the risk of developing pressure ulcers with a good sensitivity and specificity in female elderly patients.

Cadue, J. F., S. Karolewicz, et al. (2008). "[Prevention of heel pressure sores with a foam body-support device. A randomized controlled trial in a medical intensive care unit]." *Presse Medicale* 37(1 Pt 1): 30-36.

BACKGROUND: To assess in a prospective controlled study the efficacy and safety of a specific foam body-support device designed as to prevent heel pressure ulcers. **METHODS:** A randomization table was used to allocate 70 patients into 2 groups. The control group was treated with our standard pressure sore prevention protocol (half-seated position, water-mattress and preventive massages 6 times a day); the experimental group was treated with the same standard protocol as well as with the foam body-support device being evaluated. Patients were included if their Waterlow score was >10, indicating a high risk of developing pressure ulcers and if they had no skin lesion on the heels. Foam devices, covered with jersey, were constructed for the legs and allowed the heels to be free of any contact with the bed; another foam block was arranged perpendicularly to the first, in contact with the soles, to prevent ankles from assuming an equinus position (to prevent a dropfoot condition). The principal criterion for efficacy was the number of irreversible skin lesions on the heel (that is, beyond the stage of blanching hyperemia, reversible after finger pressure); these lesions were assessed every day until the end of the study (up to 30 days). **FINDINGS:** The number of irreversible heel pressure ulcers was lower in the experimental (3 patients, 8.6%) than in the control group (19 patients, 55.4%) ($p < 0.0001$). Mean time without any pressure ulcer was higher in the experimental group (5.6 days, compared with 2.8 days, $p = 0.01$). The groups did not differ in the number of pressure sores on the sacrum and leg. **CONCLUSION:** An anatomical foam body-support is effective in preventing heel pressure ulcers in patients on a medical intensive care unit and is well tolerated.

Compton, F., M. Strauss, et al. (2008). "[Validity of the Waterlow scale for pressure ulcer risk assessment in the intensive care unit: a prospective analysis of 698 patients]." *Pflege* 21(1): 37-48.

Critically ill patients are at a particular risk for developing pressure ulcers. Yet until now, no sufficiently specific, validated pressure ulcer risk assessment instruments exist for critically ill patients. In a prospective study of 698 patients of medical intensive care unit (ICU), we therefore analyzed if the Waterlow scale is suitable for pressure ulcer risk assessment in the ICU. Only patients with no pressure ulcer on admission to the ICU were included. The Waterlow scale was used to assess pressure ulcer risk on admission to the ICU, and the number of points on the scale were analyzed with regard to pressure ulcers development in the course of the ICU stay (121 patients). Our results show that adequate pressure ulcer risk assessment on admission to the ICU is not possible with the Waterlow scale. Sensitivity and specificity reached their maximal values of 64.6% and 48.8%, respectively, at a comparably high cut-off of 30 points on the Waterlow scale (positive and negative likelihood ratio being 1.26 and 0.73, respectively). The area under the curve (AUC) was 0.59 in the receiver-operator-characteristic curve. Adding intensive care related parameters to the scale yielded some degree of improvement (AUC 0.69), but the development of ICU specific pressure ulcer risk scales still seems to be necessary to allow reliable pressure ulcer risk assessment in the ICU.

Gallart, E., C. Fuentelsaz, et al. (2001). "Experimental study to test the effectiveness of hyperoxygenated fatty acids in the prevention of pressure sores in hospitalized patients [Spanish]." *Enfermeria Clinica* 11(5): 179-183.

Aim: To identify whether there are differences in the incidence of pressure sores in patients receiving preventive and those not undergoing this therapy. **Design:** A randomized, experimental study including a control and experimental group of patients. **Study site:** Hospital General Vall d'Hebron, Barcelona (Spain) from December 1999 to May 2000. **Subjects:** After calculation of the sample size required, 192 patients admitted to hospital without pressure sores and with mobility and altered activities (according to the EMINA risk scale) were included in the study. The sampling technique used was accidental including successive patients admitted to hospital. The patients were then randomly divided into two groups of 96 patients each. **Intervention:** In the control group the routine preventive therapy for pressure sores used in the hospital was applied. In addition to this preventive treatment, the experimental group also received hyperoxygenated fatty acids according to the protocol established for the study. **Results:** The incidence of pressure sores in the control group was of 35% (CI 95%; 27%-47%) and 19% (CI 95%; 12%-29%) in the experimental group; with the difference being statistically significant ($\chi^2 = 6.8$; $df = 1$; $p = 0.007$). **Conclusions:** The incidence of pressure sores was lower in the group receiving preventive treatment with hyperoxygenated fatty acids thereby indicating that this therapy may be useful in the prevention of the development of pressure ulcers in hospitalized patients.

Mazzocco, R. and A. Zampieron (2000). "[Does the evaluation of the pressure ulcer risk increase better prevention?]." *Professioni Infermieristiche* 53(3): 173-178.

The aim of the study was to indicate if pressure sore risk group patients in a 500 beds' hospital received more preventive care of a no risk control sample. Data have been collected on all patients (minimum stay of three days) from admission to discharge using an assessment dedicated tool. Results of a modified Norton Scale show that a 20% of pressure sores' risk patients receive more preventive care. A positive correlation was demonstrated particularly with: patient's position, bed side at 30 degrees inclination, pillows use, preventive local medications. However, in both groups, the general preventive intervention was definite as low. While an increase of pressure sores (12%) has been demonstrated in the risk group, no alteration has been reported in the control group.

Munoz Mella, A., Ee, et al. (2010). "Impact of a patient safety strategy aimed at reducing pressure ulcers [Spanish]." *Metas de Enfermería* **13**(4): 50-54.

Pressure ulcers (PU) are an important health problem that affects a large number of patients in all primary care settings. Most of these lesions can be avoided by implementing good nursing care. The objective of this work is to describe the application process of a specific patient safety strategy as well as the results from the evaluation of its effectiveness in terms of reduction of the incidence of pressure ulcers and efficiency, expressed in terms of a cost reduction of fungible materials and medication. The methodology used consisted of the review and update of the existing protocol, establishing new standards and methodology for the evaluation of the indicators. The results obtained were a 34% incidence reduction of PUs in two years and a 68% cost reduction derived from the cut-down of fungible materials and medication. With the prior protocol, the relative risk of developing PU was 2.17 greater than with the new protocol (CI 95% 1.77-2.64; $p = 0,000$). In our opinion, these change come from the change to a better defined strategy and the involvement of professionals through training and stimulation.

Rodriguez Torres, M. C., F. P. Garcia Fernandez, et al. (2005). "Validation of the EMINA pressure risk assessment [Spanish]." *Gerokomos* **16**(3): 174-182.

Aim: To determine the validity of EMINA risk assessment scale (RAS) for pressure ulcers (PU) in a hospital of long stay. Method: Prospective study on the patients admitted of University Hospital "Dr. Sagaz", from Jaen's Hospital Center. Inclusion criteria: All patients admitted for any pathology between the January 1st 2004 and the 31st May 2004. Exclusion Criteria: To present pressure ulcer previously. The valuation of the risk was carried out in the first 72 h. In an interval non superior to twenty-four hours was newly evaluated for another member of the team to measure the reliability. To the Preventive Care Unit of the Hospital were carried out for the patients with risk (EMINA ≤ 4). During the whole stay and on a weekly basis, was proven the appearance or not of PU. The validity analyzed indicators were: sensibility, specificity, positive predictive value (PPV) and negative (NPV), effectiveness and reability (means of the coefficient of correlation of Spearman (R) and area under the curve (AUC). The risk variables analyzed were the odds ratio and their confidence interval. Results: Of the 188 patients included in the study, a total of 15 developed PU. The best result of RAS is with the 5 point's court (sensibility in 80%, specificity 52%, PPV 12,6%, VPN 96,7%, effectiveness 54,2%. The reability obtained a R of Spearman 0,93 and the ROC 0, 84. The odds ratio with cross-section at 5 was 4,34 (CI 95% 1,18-15,91). Conclusions: The EMINA scale behaves as a good scale to determine the risk for the patients to develop PU in patients in a hospital of long stay. This predictive hability is increased if the cross-section of the risk is located at 5 points. The good level of sensibility and PNV are the two more important elements. The reliability was very appropriate because the scale has the definition of each one of the parameters of the same one. The odds ratio is adequate with the cross-section at 5. This abstract was translated into English by the publisher or author.

Segovia Gomez, T., J. Verdu Soriano, et al. (2005). "The effectiveness of a hyperoxygenated fatty acid compound in preventing pressure ulcers." *EWMA Journal* **5**(2): 27-31.

Objective: To compare the effects of Mepentol, a hyperoxygenated fatty acid preparation, with a placebo treatment in preventing the development of pressure ulcers. Method: The research study consisted of a multicentre double-blind randomised clinical trial. The incidence of pressure ulcers, relative risk (RR), preventable fraction and number necessary to treat (NNT) were calculated. In addition, Kaplan-Meier survival curves, with log-rank test, and Cox's proportional hazards regression model were used to compare both groups. Results: A total of 331 patients completed the study: 167 in the control group and 164 in the study group. Pressure-ulcer incidence during the study was 7.32% in the intervention group versus 17.37% in the placebo group ($p=0.006$). These results show that for each 10 patients treated with Mepentol one pressure ulcer was prevented (NNT = 9.95). Survival curves and the regression model showed a significant statistical difference for both groups ($p \leq 0.001$). The average cost of Mepentol during the study was euro 7.74. Conclusion: Mepentol is an effective measure for pressure ulcer prevention. It was more effective than a greasy placebo product, and was found to be cost-effective.

Torra i Bou, J. E., J. Rueda Lopez, et al. (2002). "[Heel pressure ulcers. Comparative study between heel protective bandage and hydrocellular dressing with special form for the heel]." Revista de enfermeria (Barcelona, Spain) **25**(5): 50-56.

INTRODUCTION: The heels, together with the sacra area, are one of the most frequent spots where pressure sores appear here in Spain. Any preventive measure against pressure sores on heels needs be oriented towards two main objectives: effective relief of pressure and its compatibility with localized care and skin inspection in order to detect lesions early on at least once a day. **PATIENTS, MATERIALS AND METHODS:** The authors planned a comparative, multi-centered, open, labeled and controlled study in which patients were assigned to two groups receiving these treatments: one received traditional preventive pressure sore treatment and a protective bandage on their heels while the other used a special Allevyn Heel hydrocellular dressing to protect their heels. The patients took part in this study over an eight week period. The response variable used to determine the effectiveness of the preventive measure in this study was the appearance of pressure sores. **RESULTS:** At the beginning, 130 patients were included in this study, 65 in each one of the treatment groups. In the bandage group, 50 patients finished this study while 61 in the dressing group finished this study. The appearance of pressure sores in the protective bandage group occurred in 44% of the patients, 22 out of 50, while in the dressing group, the occurrence rate was 3.3%, 2 out of 61 patients with a value of "ji" squared $p < 0.001$. The risk factor to develop a pressure sore brought us a value of relative risk of 13.42 (IC 95%: 3.31-54.3) in the group wearing the protective bandage compared to the group wearing the dressing. **COMMENTS:** The results of this study allow us to accept as valid the alternate hypothesis that there exist significant statistical differences between both treatment methods in favor of the Allevyn Heel dressing instead of the protective heel bandage. The use of this dressing, even though it is more expensive a priori than the protective bandage, in terms of unit cost for the product, has proven to be more effective in preventing pressure sores, and cheaper than the protective bandage if we bear in mind these combination of variables: time of usage, application and removal.

van Marum, R. J., P. Germs, et al. (1992). "[Norton's decubitus risk score in a nursing home]." Tijdschrift voor Gerontologie en Geriatrie **23**(2): 48-53.

Decubitus must be considered an important problem in public health care. In the Netherlands (total population 15 million) the costs of prevention and treatment of decubitus in the hospitals and nursing homes are approximately Dfl. 700 million per year. In order to identify patients at risk for the development of decubitus at an early stage. Norton and colleagues developed a scoring system that includes an assessment of general physical condition, mental status, activity level, mobility and incontinence. In a prospective study in 224 somatic nursing home patients we investigated the relationship between the Norton-score and the appearance of decubitus. The authors conclude that, when using the Norton-score, it is not possible to differentiate patients at risk clearly from patients with no risk. From the five items used by Norton, only mobility and, to a lesser degree, general physical condition, show a significant relation with the occurrence of decubitus ulcers. In order to identify the patients at risk roughly, the physician can suffice with scoring these two items.

Appendix F. Quality Assessment Methods

Individual studies were rated as “good,” “fair” or “poor” as defined below:

For Controlled Trials:

Each criterion was give an assessment of yes, no, or unclear.

1. Was the assignment to the treatment groups really random?
 - Adequate approaches to sequence generation:
 - Computer-generated random numbers
 - Random numbers tables
 - Inferior approaches to sequence generation:
 - Use of alternation, case record numbers, birth dates or week days
 - Randomization reported, but method not stated
 - Not clear or not reported
 - Not randomized
2. Was the treatment allocation concealed?
 - Adequate approaches to concealment of randomization:
 - Centralized or pharmacy-controlled randomization (randomization performed without knowledge of patient characteristics).
 - Serially-numbered identical containers
 - On-site computer based system with a randomization sequence that is not readable until allocation
 - Sealed opaque envelopes
 - Inferior approaches to concealment of randomization:
 - Use of alternation, case record numbers, birth dates or week days
 - Open random numbers lists
 - Serially numbered non- opaque envelopes
 - Not clear or not reported
3. Were the groups similar at baseline in terms of prognostic factors?
4. Were the eligibility criteria specified?
5. Were outcome assessors and/or data analysts blinded to the treatment allocation?
6. Was the care provider blinded?
7. Was the patient kept unaware of the treatment received?
8. Did the article include an intention-to-treat analysis, or provide the data needed to calculate it (i.e., number assigned to each group, number of subjects who finished in each group, and their results)?
9. Did the study maintain comparable groups?
10. Did the article report attrition, crossovers, adherence, and contamination?
11. Is there important differential loss to followup or overall high (>20%) loss to followup?

For Cohort Studies:

Each criterion was give an assessment of yes, no, or unclear.

1. Did the study attempt to enroll all (or a random sample of) patients meeting inclusion criteria, or a random sample (inception cohort)?
2. Were the groups comparable at baseline on key prognostic factors (e.g., by restriction or matching)?
3. Did the study use accurate methods for ascertaining exposures, potential confounders, and outcomes?
4. Were outcome assessors and/or data analysts blinded to treatment?
5. Did the article report attrition?
6. Did the study perform appropriate statistical analyses on potential confounders?
7. Is there important differential loss to followup or overall high (>20%) loss to followup?
8. Were outcomes pre-specified and defined, and ascertained using accurate methods?

For Studies of Diagnostic Accuracy

Each criterion was given an assessment of yes, no, or unclear.

1. Did the study evaluate a representative spectrum of patients?
2. Did the study enroll a random or consecutive sample of patients meeting pre-defined criteria?

3. Did the study evaluate a credible reference standard?
4. Did the study apply the reference standard to all patients, or to a random sample?
5. Did the study apply the same reference standard to all patients?
6. Was the reference standard interpreted independently from the test under evaluation?
7. If a threshold was used, was it pre-specified?

Appendix F References

Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomized and non-randomised studies of health care interventions. *J Epidemiol Community Health*. 1998;52(6):377-384.

Harris RP, Helfand M, Woolf SH, et al. Current methods of the U.S. Preventive Services Task Force: a review of the process. *Am J Prev Med*. 2001;20:21-35.

Whiting PF, Rutjes AW, Westwood ME, et al. QUADAS-2. A revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med*. 2011;155(8):529-536.

Appendix G. Overall Strength of Evidence Tables

Key Question 1. For adults in various settings, is the use of any risk assessment tool effective in reducing the incidence or severity of pressure ulcers, compared with other risk assessment tools, clinical judgment alone, and/or usual care?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Pressure ulcer incidence or severity: Waterlow scale vs. clinical judgment</i>	1	Good	Not applicable (1 study)	Direct	Low	1,231	Insufficient
<i>Pressure ulcer incidence or severity: Norton scale vs. clinical judgment</i>	1	Poor	Not applicable (1 study)	Direct	Low	240	Insufficient
<i>Pressure ulcer incidence or severity: Braden scale vs. clinical judgment</i>	1	Poor	Not applicable (1 study)	Direct	Low	521	Insufficient

Key Question 1a. Does the effectiveness and comparative effectiveness of risk assessment tools differ according to setting?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Not relevant</i>	0	No evidence	No evidence	No evidence	No evidence	No evidence	Insufficient

Key Question 1b. Does the effectiveness and comparative effectiveness of risk assessment tools differ according to patient characteristics, and other known risk factors for pressure ulcers, such as nutritional status or incontinence?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Not relevant</i>	0	No evidence	No evidence	No evidence	No evidence	No evidence	Insufficient

Key Question 2. How do various risk assessment tools compare with one another in their ability to predict the incidence of pressure ulcers?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Diagnostic accuracy: Braden Scale</i>	AUROC: 7 Sensitivity/specificity, cutoff ≤18: 16; all cut-offs: 32	Fair	Moderate	Direct	Moderate	AUROC: 4,811 Sensitivity/specificity, cutoff ≤18: 5,462; all cut-offs: 11,596	Moderate
<i>Diagnostic accuracy: Norton scale</i>	AUROC: 3 Sensitivity/specificity, cutoff ≤14: 5; all cut-offs: 12	Fair	Moderate	Direct	Low	AUROC: 4,191 Sensitivity/specificity: Cutoff ≤14: 2,809 All cut-offs: 5,910	Moderate
<i>Diagnostic accuracy: Waterlow scale</i>	AUROC: 4 Sensitivity/specificity, cutoff ≥10: 2; all cut-offs: 10	Fair	Moderate	Direct	Low	AUROC: 2,559 Sensitivity/specificity, cutoff ≥10: 419 all cut-offs: 3,979	Moderate
<i>Diagnostic accuracy: Cubbin and Jackson scale</i>	AUROC: 3 Sensitivity/specificity, cutoff ≤24 to 29: 3	Fair	Moderate	Direct	Low	AUROC: 865 Sensitivity/specificity, cutoff ≤24 to 29: 865	Moderate
<i>Diagnostic accuracy: Direct comparisons between risk assessment scales</i>	AUROC: 6 Sensitivity/specificity, all scales, common cut-offs: 8; all scales, all cut-offs: 14	Fair	Moderate	Direct	Moderate	AUROC: 5,921 Sensitivity/specificity, all scales, common cut-offs: 4,637 all scales, all cut-offs: 6,528	Moderate

Key Question 2a. Does the predictive validity of various risk assessment tools differ according to setting?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Diagnostic accuracy: Braden scale, across settings (direct evidence)</i>	29	Fair	Moderate	Indirect	Low	10,705	Low
<i>Diagnostic accuracy: Cubbin and Jackson, ICU setting</i>	2	Fair	Moderate	Direct	Low	646	Low
<i>Diagnostic accuracy: Braden scale, optimal cutoff in different settings</i>	9	Fair	Moderate	Indirect	Low	3,654	Low

Key Question 2b. Does the predictive validity of various risk assessment tools differ according to patient characteristics?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Diagnostic accuracy: Braden scale, differences according to race</i>	2	Fair	Low	Direct	Low	917	Low
<i>Diagnostic accuracy: Braden scale, differences according to baseline pressure ulcer risk</i>	3	Fair	Moderate	Direct	Low	3,535	Moderate

Key Question 3. In patients at increased risk of developing pressure ulcers, what is the effectiveness and comparative effectiveness of preventive interventions in reducing the incidence or severity of pressure ulcers?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Pressure ulcer incidence or severity: Static support surface vs. standard mattress</i>	11	Fair	High	Direct	Moderate	1,908	Moderate
<i>Pressure ulcer incidence or severity: Static support surface vs. static support surface</i>	7	Fair	Moderate	Direct	Moderate	634	Moderate
<i>Pressure ulcer incidence or severity: More sophisticated wheelchair cushions vs. standard wheelchair cushions</i>	4	Fair	Low	Direct	Moderate	653	Low
<i>Pressure ulcer incidence or severity: Heel ulcer prevention intervention vs. usual care</i>	2	Fair	Low	Direct	Low	291	Low
<i>Pressure ulcer incidence or severity: Heel ulcer preventive intervention vs. heel ulcer preventive intervention</i>	1	Poor	Not applicable (1 study)	Direct	Low	240	Insufficient
<i>Pressure ulcer incidence or severity: Dynamic vs. static support surfaces</i>	6	Fair	Low	Direct	Moderate	875	Low
<i>Pressure ulcer incidence or severity: Dynamic vs. dynamic support surface</i>	3	Fair	Moderate	Direct	Low	214	Low
<i>Pressure ulcer incidence or severity: Nutritional supplementation vs. standard hospital diet</i>	3	Poor	Low	Direct	Low	834	Low
<i>Pressure ulcer incidence or severity: Repositioning intervention vs. usual care</i>	3	Fair	Moderate	Direct	Low	1,097	Low

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Pressure ulcer incidence or severity: Changing incontinence pad three vs. two times daily</i>	1	Fair	Not applicable (1 study)	Direct	Low	81	Low
<i>Pressure ulcer incidence or severity: REMOIS pad vs. no pad</i>	1	Poor	Not applicable (1 study)	Direct	Low	37	Insufficient
<i>Pressure ulcer incidence or severity: Intraoperative warming vs. usual care</i>	1	Fair	Not applicable (1 study)	Direct	Low	324	Low
<i>Pressure ulcer incidence or severity: Corticotropin vs. sham</i>	1	Poor	Not applicable (1 study)	Direct	Low	85	Insufficient
<i>Pressure ulcer incidence or severity: Cream or lotion vs. placebo</i>	4	Poor	Moderate	Direct	Low	527	Insufficient
<i>Pressure ulcer incidence or severity: Skin cleanser vs. standard soap and water</i>	1	Fair	Not applicable (1 study)	Direct	Low	93	Low

Key Question 3a. Does the effectiveness and comparative effectiveness of preventive interventions differ according to *risk level* as determined by different risk assessment methods and/or by particular risk factors?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Pressure ulcer incidence or severity: Foam overlay vs. standard care, lower-risk surgical population</i>	2	Good	High	Direct	Low	588	Moderate
<i>Pressure ulcer incidence or severity: Dry polymer overlay vs. standard care, lower-risk surgical population</i>	2	Fair	High	Direct	Low	921	Low
<i>Pressure ulcer incidence or severity: Dynamic vs. static support surfaces, lower-risk surgical population</i>	2	Fair	High	Direct	Low	415	Low
<i>Pressure ulcer incidence or severity: Static vs. static support surfaces, lower-risk surgical population</i>	1	Poor	Not applicable (1 study)	Direct	Low	1,729	Insufficient

Key Question 3b. Does the effectiveness and comparative effectiveness of preventive interventions differ according to setting?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Not relevant</i>	No evidence	No evidence	No evidence	No evidence	No evidence	No evidence	Insufficient

Key Question 3c. Does the effectiveness and comparative effectiveness of preventive interventions differ according to patient characteristics?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Not relevant</i>	No evidence	No evidence	No evidence	No evidence	No evidence	No evidence	Insufficient

Key Question 4. What are the harms of interventions for the prevention of pressure ulcers?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Harms: Support surfaces</i>	7	Fair	Moderate	Direct	Low	1,891	Low*
<i>Harms: Repositioning</i>	2	Fair	Moderate	Direct	Low	884	Low*
<i>Harms: Lotions, creams and cleansers</i>	3	Fair	Moderate	Direct	Low	424	Low*
<i>Harms: Dressings</i>	1	Poor	Not applicable (1 study)	Direct	Low	37	Insufficient*

Key Question 4a. Do the harms of preventive interventions differ according to the type of intervention?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Not relevant</i>	No evidence	No evidence	No evidence	No evidence	No evidence	No evidence	Insufficient

Key Question 4b. Do the harms of preventive interventions differ according to setting?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Not relevant</i>	No evidence	No evidence	No evidence	No evidence	No evidence	No evidence	Insufficient

Key Question 4c. Do the harms of preventive interventions differ according to patient characteristics?

Details	Number of studies	Quality (Good, Fair, Poor)	Consistency (High, Moderate, Low)	Directness (Direct or indirect)	Precision (High, Moderate, Low)	Number of subjects	Strength of evidence
<i>Not relevant</i>	No evidence	No evidence	No evidence	No evidence	No evidence	No evidence	Insufficient

*Selective reporting of harms also noted.

Appendix G Reference

Owens D, Lohr KN, Atkins D, et al. AHRQ Series Paper 5: Grading the strength of a body of evidence when comparing medical interventions—Agency for Healthcare Research and Quality and the Effective Health Care Program. *J Clin Epidemiol* 2010;63(5):513-23. PMID: 19595577.

Appendix H1. Key Question 1: Data Extraction of Pressure Ulcer Screening and Clinical Outcome Studies

Author, Year	Study Design	Setting Country	Eligibility Criteria and Exclusions	Study Duration of Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Baseline Demographics (Age, Sex, Race)	Ulcer Risk
Bale, 1995 ¹	Nonrandomized trial	Hospice, Wales (presumed)	All patients admitted to hospice from May 1991 to Dec 1993	Mean (SD) A: 12 days (6) B: 13 days (5)	240/240/240	0	0	<u>A vs B</u> Mean age 67 vs. 67 years 45 % vs. 59% women Race not reported	Norton score ("adapted version") by percent per score range (A vs. B): ≤ 10: 30% vs. 29% 11—15: 41% vs. 51% ≥ 16: 29% vs. 20%
Saleh, 2009 ²	Cluster randomized trial (randomized by hospital ward)	Hospital, Saudi Arabia	Braden score ≤ 18 No other criteria described	8 weeks	NR/719/521	198 (excluded due to hospital discharge < 8 weeks)	None reported	Not reported (study conducted in a Saudi military hospital, so presumably subjects were Saudi males)	All subjects had Braden score ≤18. Details of Braden score not reported for the 3 pre-test groups or the 3 post-test groups. Reports statistically significant differences in Braden score between 3 groups, with B higher than A and C, but only p values reported (no Braden scores).
Webster, 2011 ³	Randomized trial	Hospital, Australia	Admitted between April 2009 to December 2009; excluded hospital stay less than 3 days or hospitalization more than 24 hours before baseline assessment	Mean 9 days	1,524/1,231/1,231	293	None reported	<u>A vs. B vs. C</u> Mean age 63 vs. 63 vs. 62 years 51% vs. 50% vs. 48% female Race not reported	Baseline scores not reported; 6% had pressure ulcer at baseline

Author, year	Intervention	Results	Harms	Quality rating	Funding source
Bale, 1995 ¹	<p>A: Mattresses allocated based on risk score, and re-allocated if score changed: ≤ 10: Pressure-reducing hollow core fiber overlay (Superdown) 11—15: Basic alternating air mattress overlay (Alpha Xcell) ≥ 16: "More sophisticated" alternating pressure mattress replacement (Nimbus)</p> <p>B: Pressure reducing hollow core fiber overlay (Spenco), unless patient requested special overlay used before admission. Alternating pressure mattress replacement (Nimbus) based on nurses' clinical judgment of high risk.</p>	<p><u>A vs. B</u> Incidence of pressure ulcers: 2.5% (2/79) vs. 22.4% (36/161); RR 0.11; 95% CI, 0.03 to 0.46</p>	Not reported	Poor	HNE Huntleigh (manufacturer of the alternating pressure mattress used in the study)
Saleh, 2009 ²	<p>A: a) Wound care education; b) PU prevention training, with specific training in use of Braden scale; c) Required to implement Braden scale in post-intervention period. B: Same as group A, except not required to implement Braden scale. C: a) Wound care education; b) Asked to use a 5-level clinical judgment (CJ) scale devised for the study.</p>	<p><u>A vs. B vs. C</u> <u>Pre-intervention:</u> Incidence of "nosocomial" pressure ulcer: 33.0 vs. 29.7 vs. 31.6 (chi square, p = 0.90) <u>Post-intervention:</u> Incidence of "nosocomial" pressure ulcer: 21.6 vs. 22.4 vs. 15.1 (chi square, p = 0.38)</p>	Not reported	Poor	Not reported
Webster, 2011 ³	<p>A. Assessment with Waterlow scale B. Assessment with Ramstadius scale C. Clinical judgment</p>	<p><u>A vs. B vs. C</u> Incidence of pressure ulcers: 8% (31/411) vs. 5% (22/410) vs. 7% (28/410) A vs. B: RR 1.41 (95% CI 0.82 to 2.39) A vs. C: RR 1.10 (95% CI 0.68 to 1.81) B vs. C: RR 0.79 (95% CI 0.46 to 1.35)</p>	Not reported	Good	Queensland Nursing Council, Royal Brisbane and Women's Hospital Private Practice and Research Foundation funds, Queensland Health Nursing Research Grant

Appendix H2. Key Question 1: Quality Assessment of Pressure Ulcer Screening and Clinical Outcome Trials

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to follow up: differential/high	Intention-to-treat analysis	Quality rating	Comment
Saleh, 2009 ²	Unclear	Unclear	No	Unclear	No	No	No	Unclear	No.	No	Poor	This cluster randomized trial did not report a cluster correlation coefficient
Webster, 2011 ³	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Good	

Appendix H3. Key Question 1: Quality Assessment of Pressure Ulcer Screening and Clinical Outcome Cohort Studies

Author, Year	Did the study attempt to enroll a random sample or consecutive patients meeting inclusion criteria (inception cohort)?	Were the groups comparable at baseline?	Did the study use accurate methods for ascertaining exposures, potential confounders, and outcomes?	Were outcome assessors and/or data analysts blinded to treatment?	Did the article report attrition?	Did the study perform appropriate statistical analyses on potential confounders?	Is there important differential loss to followup or overall high loss to followup?	Were outcomes pre-specified and defined, and ascertained using accurate methods?	Quality rating
Bale, 1995 ¹	Yes	No. (sex and ulcer risk differed)	Unclear (Although they report that they used Torrance's scoring system to assess skin status, they did not report the times and intervals of assessment or who made the assessments)	No	Yes	No	No	Unclear (See previous comment)	Poor

Appendix H4. Key Question 2: Data Extraction of Pressure Ulcer Risk Assessment Studies

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Multiple scales									
Boyle , 2001 ⁴	Prospective cohort	Cubbin and Jackson Waterlow	Hospital inpatient; ICU Australia	Not reported	Symptomatic: excluded from analysis History of PUs: unclear Specific findings: unclear	NR/ NR/ 534/ 534	Mean age 58 years 37% female Race not reported	Cubbin and Jackson: 33 (SE 0.4) Waterlow: 29 (SE 0.4)	Unclear; mean length of stay in ICU 4 days
DeFloor, 2005 ³	Prospective cohort	Braden Norton	Long-term care facilities (n=11) Belgium	Not reported	Symptomatic: included History of PUs: included Specific findings: if pressure ulcers present at baseline, patient included but those pressure ulcers excluded from analysis	NR/ NR/ 1,772/ 1,772	Mean age 85 years (SD 8) 79% female Race not reported	Braden: 17 (SD 4) Norton: 14 (SD 4)	4 weeks
Feuchtinger , 2007 ⁶	Prospective cohort	Braden Modified Norton 4-factor model (sensory perception, moisture, friction/shear, age)	Hospital inpatient; cardiac ICU Germany	Admitted to the cardiac ICU with a length of stay \geq 24 hours	Symptomatic: excluded History of PUs: unclear Specific findings: unclear	NR/ NR/ 53/ 53	Mean age 62 years (range 25-83) 42% female Race not reported	Mean not reported	Mean 3 days (range 1-8 years)
Jalali, 2005 ⁷	Prospective cohort	Braden Gosnell Norton Waterlow	Hospital inpatient Iran	Age \geq 21 years; admitted to hospital within 48 hours of study entry; expected hospital stay \geq 14 days; no PU	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 230/ 230	Mean age 60 years (range 21-89 years) 57% women Race not reported	Not reported for all scales	Not reported (minimum followup 14 days)

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Kim, 2009 ⁸	Prospective cohort	Braden Cubbin and Jackson Song and Choi	Hospital inpatient; surgical ICU South Korea	Age ≥16 years; no pressure ulcer on admission to surgical ICU	Symptomatic: excluded History of PUs: unclear Specific findings: unclear	NR/ NR/ 219/ 219	Mean age 58 years (SD 1.2) 34% female Race not reported	Mean not reported	11.3 days (range 3-90 days)
Kwong, 2005 ⁹	Prospective cohort	Braden Modified Braden Norton	Hospital inpatient (acute care) China	Admitted to any ward of one of two acute care hospitals within 24 hours of study entry, no pressure ulcers	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 429/ 429	Mean age 54 years (SD 17; range 5-93) 41% female Race not reported	Mean not reported	11 days (range 5-21 days)
Pang, 1998 ¹⁰	Prospective cohort	Braden Norton Waterlow	Hospital inpatient Hong Kong	Age ≥21 years, newly admitted to medical or orthopedic unit, no history of psychiatric illness; no pressure sore; expected stay at least 14 days	Symptomatic: excluded History of PU: unclear Specific findings: no incidence of grade I-IV PU according to Torrance Developmental Classification of Pressure Sores	NR/ NR/ 138/ 106	Mean age not reported; range 45-92 years, 84% ≥years 51% female 100% Chinese	Mean not reported	11.7 days (range 2-17 days)
Perneger, 2002 ¹¹	Prospective cohort	Fragement Scale (score 0-9: friction, age, mobility, mental status; lower score=lower risk) Braden Norton	Hospital inpatient Switzerland	Admitted between March and June 1997	Symptomatic: included History of PU: unclear Specific findings: 2% had pressure ulcers on admission but those patients were excluded from analysis	NR/ NR/ 1,190/ 1,190	Mean age 61 years (range 16-96 years)	Fragement 2.0 (SD 2.1) Braden, Norton mean not reported	9 days (based on 10,415 total patient-days)
Salvadarena, 1992 ¹²	Prospective cohort	Braden Clinical judgment	Hospital inpatient (acute care) United States	Admission <48 hours prior to study enrollment, expected duration of stay at least 2-3 days after initial data collection, no existing pressure ulcers	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 99/ 99	Mean age 72 years 64% female 80% white 7% non-white 13% no data	Mean 18.1 (SD 3.3)	Mean not reported; mean duration of stay 5.2 days

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Schoonhoven , 2002 ¹³	Prospective cohort	Braden Norton Waterlow	Hospital inpatient The Netherlands	Age ≥18 years admitted to the surgical, internal, neurological or geriatric wards of 2 hospitals in the Netherlands; expected stay at least 5 days; no PU on admission	Symptomatic: excluded History of PUs: unclear Specific findings: unclear	6,000/ 1,536/ 1,431/ 1,229	Mean age 60 years 55% women Race not reported 62% surgical 22% internal medicine 10% neurology 6% geriatric 5% used preventive measures	Braden: 19.6 Norton:16.8 Waterlow: 13.0	4 weeks
Seongsook, 2004 ¹⁴	Prospective cohort	Braden Cubbin and Jackson Douglas	Hospital inpatient; surgical, internal or neurological ICU South Korea	Age ≥21 years; admitted to ICU	Symptomatic: unclear History of PUs: unclear Specific findings: unclear	NR/ 125/ 112/ 112	Mean age 62 years 43% female Race not reported	Mean not reported	Unclear; duration 2 months
van Marum, 2000 ¹⁵	Mixed (Norton data prospective, CBO data retrospective)	Norton Dutch CBO	Nursing home The Netherlands	Age >64 years; newly-admitted; not admitted for psychogeriatric care; examined for pressure sores within 48 hours of admission	Symptomatic: excluded History of PUs: unclear Specific findings: unclear	NR/ NR/ 319/ 267	Mean age 79 years Race not reported 64% female (based on 220/267 patients with CBO data)	Mean not reported	Mean not reported; total duration 4 weeks
VandenBosch , 1996 ¹⁶	Prospective cohort	Braden Clinical judgment	Hospital inpatient (general care, ICU, inpatient rehab) United States	Age ≥18 years, randomly selected with expected hospital stay at least 1 week	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 103/ 103	Mean age 64 years 52% female 86% white 12% black 2% other	18; among patients who developed PU mean score 16.6, patient with no PU mean score 18.2	Up to 2 weeks or until discharge
Wai-Han, 1997 ¹⁷	Prospective cohort	Norton Waterlow	Geriatric care facility Hong Kong	Age >70 years, hospital stay at least 24 hours	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 185/ 185	Mean age 80 years 56% female Race not reported	Not reported	Mean not reported; study duration 4 weeks

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Braden scale									
Baldwin , 1998 ¹⁸	Prospective cohort	Braden	Hospital inpatient (trauma center) United States	Age 15-60 years, previously healthy, hospitalized as a result of severe trauma but not requiring burn fluid resuscitation, expected hospitalization of at least 1 week	Symptomatic: unclear History of PU: unclear Specific findings: unclear	NR/ NR/ 36/ 36	Mean age 32 years 28% female 42% white 39% Latino 11% black 8% Asian	Mean not reported	27 days (range 8-65 days)
Barnes, 1993 ¹⁹	Prospective cohort	Braden	Hospital inpatient United States	Age ≥50 years, no pressure sores, not receiving chemotherapy or radiotherapy	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 361/ 361	Mean age not reported (range 50 to 90 years) 49% female Race not reported	Not reported	Up to 15 days
Bergstrom, 1987a ²⁰	Prospective cohort	Braden	Hospital inpatient United States	Admitted to one of two hospital nursing units with on pressure ulcer	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 200/ 199 (reported in 2 studies)	Study 1 - Mean age 57 years 49% female 74% white 26% other Study 2 - Mean age 50 years 49% female 77% white 23% other	Study 1: 20 Study 2: 17	Mean not reported; total follow-up Study 1: 6 weeks, Study 2: 12 weeks
Bergstrom, 1987b ²¹	Prospective cohort	Braden	Hospital inpatient; adult ICU United States	Consecutively admitted to ICU with no pressure sore on admission	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 60/ 60	Mean age 59 years 53% female 88% white 10% black 2% other	Mean 16; among patients who developed PU mean score 13.8, patients without PU mean score 16.9	2 weeks

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Bergstrom, 1992 ²²	Prospective cohort	Braden	Skilled nursing facility United States	Age >65 years, Braden score <17, no pressure ulcers, expected duration of stay >10 days	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	1,913/ 681/ 200/ 200	Mean age 80 years 70% female 95% white 5% other	Total cohort: 19 Patients with PU: 14 Patients without PU: 16	Mean not reported; followup was up to 12 weeks; 49% had follow up of 4 weeks; 15% of original cohort followed to study's end
Bergstrom, 1998 ²³ Other publications: Bergstrom, 2002 ²⁴	Prospective cohort	Braden	Tertiary care, VA medical centers, skilled nursing facilities (SNF) USA	Age >19 years, free of existing pressure ulcers, admitted within the previous 72 hours; participants randomly selected	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ NR/ 843	Mean age 62 years (range 19-102 years) 37% female 21% non-white	Mean not reported	1 to 4 weeks
Bergstrom, 2002 ²⁴ Other publications: Bergstrom, 1998 ²³	Prospective cohort, subgroup analysis	Braden	Tertiary care, VA medical centers, skilled nursing facilities (SNF) USA	Age >19 years, free of existing pressure ulcers, admitted within the previous 72 hours; participants randomly selected	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ 843/ 825/ 821	Mean age 62 years (range 19-102 years) 37% female 21% non-white	Total cohort: 19 Patients with PU: 16 Patients without PU: 20	1 to 4 weeks
Braden, 1994 ²⁵	Prospective cohort	Braden	Hospital, skilled nursing facility (extended care) United States	Age ≥19 years, no pressure ulcers, admitted within previous 72 hours	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	453/ 177/ 123/ 102	Mean age 75 years 72% female Race not reported	Mean score - Patients with PU: 16 Patients without PU 20	4 weeks
Capobianco 1996 ²⁶	Prospective cohort	Braden	Hospital inpatient United States	Medical or surgical inpatients with no preexisting skin ulcerations	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 50/ 50	Mean age 66 years (SD 19; range 20-95) 64% female 86% white 10% black 4% Hispanic Mean duration of stay 8 days (SD 3; range 3 to 14)	Not reported; among patients who developed PU mean score 16 (SD 8; range 9 to 23)	Not reported for entire cohort; among patients who developed PUs: mean 9 days (SD 5; range 3 to 14)

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Chan, 2005 ²⁷	Prospective cohort	Braden	Hospital inpatient Singapore	Age ≥18 years, newly admitted with no pressure ulcers	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 666/ 666	Mean age 64 years (SD 18) 48% female 77% Chinese 10% Malaysian 9% Indian 4% other	Mean 18.3 (SD 3.8) Low-risk (Braden 16-23): 75% Moderate risk (Braden 12-15): 17% High-risk (Braden 6-11): 8%	Mean duration of hospital stay 13 days; maximum 28 days
Chan, 2009 ²⁸	Prospective cohort	Braden Modified Braden	Hospital inpatient (orthopedic unit) Hong Kong	Age ≥18 years, Chinese, expected stay of at least 5 days, not ambulant, no pressure ulcer	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 197/ 197	Mean age 79 years 85% female 100% Chinese	Mean not reported	Mean not reported; mean duration of hospitalization 11 days (range 5-53 days)
Goodridge 1998 ²⁹	Prospective cohort	Braden	Hospital and long-term facility inpatients Canada	Age ≥65 years, newly admitted with no dermal ulcers.	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 330/ 330	Mean age 79 years (SD 9) Gender not reported Race not reported	Mean 18 (SD 3; range 6-24)	2 months
Hagisawa, 1999 ³⁰		Braden	Hospital inpatient Japan	Admitted to internal medical ward; short-stay patients excluded	Symptomatic: included History of PU: unclear Specific findings: >1% had pressure sores at baseline	NR/ NR/ 275/ 275	Not reported	Not reported; 87% Braden >17 at baseline	Not reported; study duration 1 year
Hafens, 2000 ³¹	Prospective cohort	Braden Extended Braden	Hospital inpatient The Netherlands	No pressure sore on admission, Caucasian, probably stay of at least 10 days	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 320/ 320	Mean age 61 years 48% female 100% white	Not reported	Not reported; 10-day or more anticipated stay inclusion criteria

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Langemo, 1991 ³²	Prospective cohort	Braden	Mixed inpatient and outpatient settings: acute care, skilled care, rehabilitation facility, home care and hospice United States	Age ≥18 years, medical or surgical patients, enrollment within 24-72 hours of admission, no pressure ulcers	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 190/ 190 (Acute care n=74; skilled care n=25; rehabilitation n=40; home care n=30; hospice n=20)	Mean age 66 years (range 21-99) 56% female 96% white 4% Native American	Mean 18 (SD 3)	Means not reported; duration varied according to setting - Acute care: At least 5 days, maximum 2 weeks Skilled care, rehabilitation, home care, hospice: up to four weeks or until discharge
Lewicki, 2000 ³³	Prospective cohort	Braden	Acute care hospital (undergoing cardiac surgery) USA	Age ≥21 years undergoing cardiac surgery between February and March 1995 and no pressure ulcer on enrollment	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ NR/ 337	Mean age 62 years 25% female Race not reported	Not reported	5 days
Lyder, 1998 ³⁴	Prospective cohort	Braden	Hospital inpatient (general medical and surgical units) United States	Age ≥60 years, consecutively admitted, black or Latino/Hispanic, expected duration of stay ≥5 days, no pressure ulcer	Symptomatic: excluded History of PUs: included (3/36) Specific findings: no pressure ulcer on admission	43/ 43/ 43/ 36	Mean age 71 years (SD 7) 58% female 72% black 28% Latino/Hispanic	Not reported	Mean not reported
Lyder, 1999 ³⁵	Prospective cohort	Braden	Hospital inpatient United States	Age ≥60 years, consecutively admitted, black or Latino/Hispanic, expected duration of stay ≥5 days, no pressure ulcer	Symptomatic: excluded History of PUs: unclear Specific findings: no pressure ulcer on admission	NR/ 84/ 74/ 74	Mean age 72 years (range 60-99) 66% female 70% black 30% Hispanic/Latino	Not reported	Not reported

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Olson, 1998 ³⁶	Prospective cohort	Braden	Hospital inpatient (oncology) Canada	All adult patients admitted to oncology nursing unit between January and May 1993; subsequent study enrolled patients between October 1994 and June 1995	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	Study 1 (1993 results) - 186/142/128/128 Study 2 (1996 results) - 508/488/488/418	Study 1 - Mean age 55 years Gender not reported Race not reported Study 2 - Mean age 56 years Gender not reported Race not reported	Not reported	Not reported
Ramundo, 1995 ³⁷	Prospective cohort	Braden	Home care United States	Unable to leave bed or chair	Symptomatic: unclear History of PU: unclear Specific findings: free of "skin breakdown"	NR/ NR/ 48/ 48	Not reported	Total cohort: 18 Patients with a PU: 17 Patients without PU: 18	Mean not reported; followup up to 4 weeks or until discharge or development of pressure ulcer
Serpa, 2011 ³⁸	Prospective cohort (post-hoc analysis of data from another prospective study)	Braden	Hospital ICU Brazil	Age ≥18 years, no pressure ulcer on first assessment, hospitalized for at least 24 hours but no more than 48 hours, Braden score ≤18	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	82/ 72/ 72/ 72	Mean age 61 years (SD 17) 36% female Race not reported	Mean not reported; 31% characterized as low-risk, 40% as moderate risk, 29% as high-risk at baseline	Unclear; mean duration of hospitalization 17 days (range 6 to >31 days) but only data from 3 consecutive assessment included in analysis

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Tourtual, 1997 ³⁹	Prospective cohort (results of 2 studies reported; see comments)	Braden	Hospital inpatient United States	Admitted to one of four hospital nursing units	Symptomatic: included (4% prevalence at baseline) History of PUs: unclear Specific findings: unclear	Study 2: 609/ NR/ 291/ 291	Mean age 68 years 58% female Race not reported	Mean 17.6; among patients who developed PU mean score 16.2, patients without PU mean score 18.4	Unclear; mean duration of hospitalization for entire cohort 10 days; 17 days for patients who developed a PU vs. 8 days for patients who did not develop a PU
Norton scale									
Bale, 1995 ¹	Prospective cohort	Modified Norton (Norton scale customized for this study, higher score represented higher pressure ulcer risk)	Hospice England	Entered hospice care between December 1992 and December 1993 (Phase 2)	Symptomatic: excluded History of PU: unclear Specific findings: analysis limited to patients with no pressure ulcers on admission	NR/ NR/ 79/ 79* <i>* Subgroup of patients with no pressure ulcer on admission to Phase 2</i>	Mean age 67 years 45% female Race not reported	Mean not reported; 30% ≤10 32% 11-15 29% ≥16	Not reported
Lincoln, 1986 ⁴⁰	Prospective cohort	Norton	Hospital inpatient (medical or surgical) United States	Age >65 years, no pressure sores on admission	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 50/ 36	Mean age 72 years (range 65-89) 54% female Race not reported	Mean not reported; 34/36 (94%) score ≥15	Mean not reported; mean duration of stay 8 days (range 2-26 days)
Stotts, 1988 ⁴¹	Prospective cohort	Modified Norton (same items as the standard Norton scale, with clarification regarding specific operational definitions)	Hospital inpatient (surgical) United States	Age >18 years, electively admitted to cardiovascular or neurosurgery surgical service	Symptomatic: unclear History of PU: unclear Specific findings: unclear	NR/ NR/ 387/ 387	Mean age 53 years (range 17-86 years) 47% female Race not reported	Mean 19 (SD 2.5)	Mean not reported; followup up to 3 weeks

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Waterlow scale									
Compton, 2008 ⁴²	Prospective cohort	Waterlow	Hospital inpatient (ICU) Germany	Admitted to medical ICU between April 2001 and December 2004 with no pressure ulcer with ICU stay >72 hours	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ 713/ 698/ 698	Median age 66 years 44% female Race not reported	Not reported	Mean not reported; median length of ICU stay 6 days
Edwards, 1995 ⁴³	Prospective cohort	Waterlow	Home care England	Patients being visited by community health nurses in a South London district health authority, no pressure sores	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	80/ NR/ 31/ 31	Mean age 83 years (SD 6; range 71-96) 65% female 97% white 3% Asian	Mean 17	Unclear
Serpa, 2009 ⁴⁴	Prospective cohort	Waterlow	Hospital inpatient (ICU) Brazil	Age ≥18 years, admitted from January to July 2006 within 24-48 hours, no pressure ulcer, Braden score ≤18, Waterlow score ≥16, at least 3 consecutive measures	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	187/ 113/ 98/ 98	Mean age 71 years (SD 16) Proportion female not reported; text states gender distribution was even Race not reported 40% hypertensive 25% diabetic	Not reported; study protocol required Waterlow score ≥16 at time of study entry	Not reported; patients assessed every 48 hours until development of a pressure ulcer, discharge or transfer or death
Webster, 2010 ⁴⁵	Prospective cohort	Waterlow	Hospital inpatient Australia	Admitted to any internal medicine ward	Symptomatic: included (6%) History of PU: included Specific findings: unclear	NR/ NR/ 274/ 200	Mean age 65 years (SD 18) 50% female Race not reported	Not reported	Not reported
Westrate, 1998 ⁴⁶	Prospective cohort	Waterlow	Hospital inpatient (ICU) The Netherlands	Admitted to surgical ICU in 1994, with stay at least 24 hours and no pressure sores or use of preventive measure (mattress)	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	686/ 594/ 594/ 594	Mean age 59 years (range 9 to 96) 35% female Race not reported	Mean 17	Mean not reported; mean length of stay in ICU 6 days

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Other scales									
Andersen, 1982 ⁴⁷	Prospective cohort	Risk assessment based on age ≥70 years, reduced mobility, incontinence, pronounced emaciation, redness over bony prominence	Hospital inpatient (acute care) Denmark	Admitted to acute care ward between January 17 and August 18, 1977, no pressure ulcers on admission	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	3,571/ 3,516/ 3,398/ 3,398	Not reported	Mean not reported; 14% had a risk score ≥2, indicating increased PU risk	10 days in-hospital observation; 3-months total observation
Hatanaka, 2008 ⁴⁸	Prospective cohort	Novel indicator consisting of hemoglobin, CRP, albumin, age, gender	Hospital inpatient Japan	Bedridden patients hospitalized for a respiratory disorder with no pressure ulcer	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 149/ 149	Mean age 72 years (SD 11) 30% female Race not reported	Mean Braden 15	Mean 33 days (range 5-79 days)
Lindgren, 2002 ⁴⁹	Prospective cohort	Risk Assessment Pressure Sore Scale (RAPS)	Hospital inpatient Sweden	Age ≥17 years; newly admitted to medical, surgical, infection, orthopedic, rehabilitation or geriatric ward; expected hospital stay of at least 5 days; for surgical patients, expected duration of surgery at least 1 hour	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ 588/ 530/ 488	Mean age 70 years (SD 14 years) 50% female Race not reported	Mean not reported	Mean not reported; maximum followup 12 weeks; 50% of patients had ≤8 days followup
Page, 2010 ⁵⁰	Prospective cohort	Northern Hospital Pressure Ulcer Prevention Plan (TNH-PUPP)	Hospital general ward, critical care or emergency department Australia	Acute care patients	Symptomatic: unclear History of PU: unclear Specific findings: unclear	NR/ NR/ 165/ 165	Mean age 68 years (SD 18) 47% female Race not reported	Mean not reported	Mean not reported; mean length of hospital stay 15 days

Author, year	Study Design	Screening Test/Scale	Setting Country	Inclusion Criteria	Study excluded: Symptomatic patients? Patients with history of PUs? Patients with specific findings	Number Screened/ Eligible/ Enrolled/ Analyzed	Baseline Demographics	Mean Risk Score at Baseline	Mean Followup
Towey, 1988 ³¹	Prospective cohort	Knoll Decubitus Ulcer Potential Scale (incorporates general health, mental health, activity, mobility, incontinence, oral nutrition intake, oral fluid intake, predisposing diseases)	Long-term care facility United States	Age >65 years admitted to long-term care facility, no pressure ulcer on admission	Symptomatic: excluded History of PU: unclear Specific findings: no pressure ulcers on admission	NR/ NR/ 60/ 60	Mean age 81 years (range 65-97 years) 80% female 72% white 15% black 2% Asian 11% unknown	Mean 14 (range 3 to 23)	28 days

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Multiple scales							
Boyle, 2001 ⁴	Stirling Pressure Sore Severity Scale - Stage 0: no evidence of pressure sore Stage 1: Discoloration of intact skin Stage 2: Partial-thickness skin loss or damage involving epidermis or dermis Stage 3: Full thickness skin loss extending to subcutaneous tissue Stage 4: Full thickness skin loss extending to bone, tendon or joint	None; no adjusted analyses conducted	Routine preventive care given, including turning every 2-4 hours and mattress overlay or special mattress	5% (28/534)	Unclear	none	Cubbin and Jackson ≤ 29 Waterlow ≥ 10
DeFloor, 2005 ⁵	EPUAP - Grade 1: non-blanchable erythema Grade 2: partial-thickness skin loss or damage involving epidermis and/or dermis Grade 3: full-thickness skin loss with necrosis of epidermis or dermis Grade 4: full-thickness skin loss involving damage or necrosis of epidermis and/or dermis extending to the underlying bone, tendon or capsule	None; no adjusted analyses conducted incorporating risk scores	18% (314/1,772) turning every 2-4 hours + pressure reducing mattress; other patients (n=1,458) received water mattresses (11%; 188/1,772), small cell alternating mattresses (4%; 63/1,1772), sheepskins (8% 139/1,772), gel cushions (2%; 40/1,772) or no preventive interventions (58%; 1,028/1,772) as deemed clinically appropriate	Nonblanchable erythema: 20% (363/1,772) Grade 2 or higher pressure ulcer: 11% (187/1,772)	Unclear	none	Braden <17, <18 Norton <12, <14 Clinical judgment risk vs. no-risk
Feuchtinger, 2007 ⁶	EPUAP - Grade 1: non-blanchable erythema Grade 2: partial-thickness skin loss or damage involving epidermis and/or dermis Grade 3: full-thickness skin loss with necrosis of epidermis or dermis Grade 4: full-thickness skin loss involving damage or necrosis of epidermis and/or dermis extending to the underlying bone, tendon or capsule	None; no adjusted analyses conducted	Unclear	49% (26/53)	Preop, postop and once each of the four following days	none	Braden ≤ 16 ; ≤ 20 Modified Norton ≤ 21 ; ≤ 23 ; ≤ 25 4-factor model ≥ 2

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Jalali, 2005 ⁷	Stage 1: nonblanchable erythema of intact skin Stage 2: partial-thickness skin loss Stage 3: full-thickness skin loss Stage 4: full-thickness skin loss with tissue necrosis, bone damage, etc.	None; no adjusted analyses conducted	Preventive measures (not described)	32% (74/230)	Once a day for up to 14 days	none	Cutoffs unclear
Kim, 2009 ⁸	AHRQ 4-stage criteria	None; no adjusted analyses conducted	"Ordinary" nursing interventions	18% (40/219)	Once daily until discharge from surgical ICU	none	Braden ≤14 Cubbin and Jackson ≤28 Song/Choi ≤21
Kwong, 2005 ⁹	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or derma Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Turning 39% (168/429); pressure reducing item, e.g. cushion, air ring, etc. 35% (152/429); clean/dry bedding 34% (148/429); clean/dry skin 48% (205/429); positioning 40% (170/429); use of draw sheet for lifting 21% (91/429); massage 23% (97/429)	2% (9/429)	On admission, then daily until development of a pressure ulcer, transfer/discharge, or 21 days of followup	none	Braden ≤14 Modified Braden ≤16 Norton ≤14
Pang, 1998 ¹⁰	Torrance Developmental Classification of Pressure Sores: Grade I: discoloration of skin with persistent erythema Grade II: loss of skin layer involving epidermis and penetrating into dermis Grade III; IV: NR; participant removed from study once identified	None; no adjusted analyses conducted	Turning, positioning, use of pillows, bed cradles, sheepskin pads, clean sheets, footboard, water mattress, air mattress and/or Stryker frame, massage; rates not reported	20% (21/106)	Once daily for up to 14 days	none	Braden ≤18 Norton ≤16 Waterlow ≥16
Perneger, 2002 ¹¹	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	Adjustment for individual risk factors but not for total risk score (except for Fraggment scale)	24% (288/1,190) received special pillow, mattress or bed or regular change in position	15% (182/1,190)	On admission, then twice a week for up to 3 weeks	Univariate and multivariate logistic regression for individual risk factors	Fraggment >3 Not reported for Braden, Norton
Salvadarena, 1992 ¹²	Braden and Bergstrom criteria	None; no adjusted analyses conducted	Preventive measures given but not described	20% (20/99)	On admission, then every Monday, Wednesday and Friday until discharge	none	Braden cutoff ≤15, ≤18 Clinical judgment:

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Schoonhoven, 2002 ¹³	Nurse assessed using individual risk factors from all three scales	None; no adjusted analyses conducted	Preventive measures (not described) used; text states that use of preventive measures did not affect risk score or subsequent development of pressure ulcers	Total cohort: 11% (135/1229)	Within 48 hours of admission, then weekly for up to 12 weeks	none	Braden <18 Norton <16 Waterlow >9
Seongsook, 2004 ¹⁴	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Water mattresses; massage; position change every 2 hours	31% (35/112)	Within 24-72 hours of admission, followed by afternoon observations on Monday, Wednesday and Friday of each week	none	Braden ≤16 Cubbin and Jackson ≤24 Douglas ≤18
van Marum, 2000 ¹⁵	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Preventive measures given but not described	20% (54/267)	Within 48 hours of admission, then weekly (some patients assessed more frequently, but details not provided)	none	Norton ≤16 Dutch CBO ≤10
VandenBosch, 1996 ⁵²	Stage I: nonblanchable erythema that does not disappear for 24 hours after pressure relief Stage II: break in the skin, i.e. blisters or abrasions Stage III: break in skin exposing subcutaneous tissue Stage IV: break in the skin extending through tissue exposing muscle or bone	None; no adjusted analyses conducted	Preventive measures given but not described	28% (29/103)	On admission, then every Monday, Wednesday and Friday until time of discharge; maximum number of observations=6	none	Braden ≤17 Clinical judgment risk vs. no risk
Wai-Han, 1997 ¹⁷	Not described	None; no adjusted analyses conducted	Preventive measures given but not described	4% (8/185)	On admission, then weekly until discharge or death	none	Norton ≤14 Waterlow ≥10

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Braden scale							
Baldwin, 1998 ¹⁸	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	No adjusted analyses incorporating Braden score	All patients received pressure reducing mattresses; 58% (21/36) also received additional pressure relieving or reducing support (not described)	31% (11/36)	Within 24 hours of admission, then biweekly until discharge	none	Braden ≤10, ≤15
Barnes, 1993 ¹⁹	Grade I: erythema that does not resolve within 30 minutes of pressure relief while epidermis remains intact (presence of Grade I pressure ulcer resulted in discharge from study)	None; no adjusted analyses conducted	Not reported	6% (22/361)	Daily, until time of discharge, development of Grade I pressure ulcer or 15 days	none	Braden ≤16
Bergstrom, 1987a ²⁰	Stage I: erythema only Stage II: break in skin, e.g. blisters, abrasions Stage III: break in skin exposing subcutaneous tissue Stage IV: break in skin extending through tissue and subcutaneous layers exposing muscle and bone	None; no adjusted analyses conducted	Standard care given but not described	Study 1: 7% (7/99) Study 2: 9% (9/100)	Within 72 hours of admission, then weekly until discharge from unit or death	none	Braden ≤16
Bergstrom, 1987b ²¹	Skin assessment tool, comprising scores from 0 (no redness or breakdown) to 4 (break in skin extending through subcutaneous layers and into muscle)	None; no adjusted analyses conducted	Egg crate mattress, turning, special bed, elbow protectors, heel protectors, other	40% (24/60)	Within 24-72 hours of study admission, then every 48 hours for 2 weeks	none	Braden ≤15, ≤18
Bergstrom, 1992 ²²	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	Age, SBP, DBP, temperature, protein intake, caloric intake, serum albumin, BMI, Braden score	Egg crate foam 61% (121/200); turning every 2 hours 44% (88/200); heel, elbow and/or sacral pad 14% (28/200); foot cradle 4% (8/200); jelly pad 3% (6/200); other 3% (6/200)	74% (147/200)	On admission, weekly for the first 4 weeks, then bi-weekly for remainder of time on study	Logistic regression	Braden <14

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Bergstrom,, 1998 ²³ Other publications: Bergstrom, 2002 ²⁴	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Not reported	Any pressure ulcer: 13% (108/843) <u>By severity</u> Stage I: 4% (35/843) Stage II: 9% (73/842) <u>By setting</u> Tertiary care: 9% (26/306) VA: 7% (21/282) SNF: 24% (61/255)	On admission (time point A) and 48 to 72 hours after admission (time point B)	none	Braden ≤15, ≤18 Results stratified by time point, setting
Bergstrom, 2002 ²⁴ Other publications: Bergstrom, 1998 ²³	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	Braden score, age, sex, DBP, SBP, temperature	Not reported	Total cohort: 13% (108/843) Blacks: 5% (8/159) Whites: 15% (98/662*) *data missing for 4 patients	Unclear, from time of admission to discharge	Logistic regression	Braden ≤15, ≤18 Results stratified according to race
Braden, 1994 ²⁵	Stage 1: nonblanchable erythema for 2 consecutive study days Stage 2: blisters, abrasions, etc. Stage 3: break in skin exposing subcutaneous tissue Stage 4: break in skin exposing or extending into muscle or bone	None; no adjusted analyses conducted	Not reported	28% (28/102)	Every 48-72 hours	none	Braden ≤15, ≤18 at last observation (either prior to PU development or end of follow up)
Capobianco, 1996 ²⁶	Assessment by observer blinded to Braden score; PUs staged 1-4	None; no adjusted analyses conducted	Preventive measures given but not described	28% (14/50)	On admission, then every Monday, Wednesday and Friday until time of discharge (final assessment at time of discharge)	none	Braden ≤18
Chan, 2005 ²⁷	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	Braden score, age, race, gender, length of hospital stay, medical diagnosis, risk factors	Not reported	12% (81/666)	On admission to study, then twice weekly until discharge or 28 days of followup	Logistic regression	Low, moderate or high risk according to Braden score

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Chan, 2009 ²⁸	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Preventive measures given but not described	9% (18/197)	Daily	none	Braden ≤16 Modified Braden ≤19
Goodridge, 1998 ²⁹	Unblinded assessment by research assistants not involved in patient care	Unclear; text states adjustment but doesn't report results	Turning, ambulation, exercise, positioning, padding, seating assessment, pressure reducing, relieving mattress, lotions, incontinence management, nutrition management; 3-11 interventions used depending on baseline Braden score	10% (32/330)	Bi-weekly	none	Braden ≤15, ≤18
Hagisawa, 1999 ³⁰	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Varied by protocol based on Braden score	5% (14/275; includes 2 patients with pressure ulcer on admission)	On admission, one week later, then varied according to Braden score (>23 assessed monthly; <23 assessed weekly)	none	Braden ≤16

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Hafens, 2000 ³¹	Pressure sore incidence - Stage 1: non-blanching erythema of intact skin Stage 2: partial-thickness skin loss or damage involving epidermis and/or blister and shallow ulcer Stage 3: full-thickness skin loss involving damage or necrosis of epidermis and/or dermis, not extending to underlying bone, tendon or joint capsule Stage 4: full-thickness skin loss involving damage or necrosis of epidermis and/or dermis extending to underlying bone, tendon or capsule	Urine incontinence, fecal incontinence, extreme sweating, diabetes, Quetlet index, physical health, mental health, smoker, pressure sore in past, age evaluated in univariate analysis Age, moisture included in logistic regression model	Anti-decubitus mattress, mobilization or position change: 55% (177/320)	All: 15% (47/320) Among patients using preventive treatments (high-risk): 21% (38/177)	On admission and every 5 days	Stepwise logistic regression	Braden ≤15, ≤18 Extended Braden ≤15, ≤18
Langemo, 1991 ³²	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Unclear; "normal" procedures followed according to each unit's policies	Total cohort: 9% (18/190) Acute care: 15% (11/74) Skilled care: 28% (7/25)	On admission, then varied according to setting - Acute care: 3 times per week Skilled care: weekly Rehabilitation: 2 times per week Home care: weekly Hospice: weekly	none	Braden ≤15 (acute care), ≤18 (skilled care)
Lewicki, 2000 ³³	Wound, Ostomy and Continence Nurses Society 4-stage criteria	None; no adjusted analyses conducted	Varied by protocol based on Braden score	5% (16/337)	Preoperatively, POD 1, POD 3, POD 5	none	Braden cutoff ≤15, ≤18 Results stratified by time point
Lyder, 1998 ³⁴	Stage I: nonblanchable erythema for more than 24 hours Stage II: superficial break in skin, blisters or abrasions, epidermal or dermal layer exposed Stage III: break in skin exposing subcutaneous tissue Stage IV: break in skin exposing muscle or bone	None; no adjusted analyses conducted	Not reported	39% (14/36)	Within 48-72 hours of study admission, then Mondays, Wednesdays and Fridays until time of discharge	none	Braden ≤16

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Lyder, 1999 ³⁵	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Not reported	32% (24/74)	Within 24-48 hours of study admission, then Mondays, Wednesdays and Fridays until time of discharge	none	Braden ≤16 (in patients age ≤74 years) ≤18 (in patients age ≥75 years)
Olson, 1998 ³⁶	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Preventive measures given to patients with Braden score ≤16, including sensory perception awareness, moisture, mobility/activity, nutrition, friction/shear	Study 1 - 9% (11/128) Study 2 - 10% (43/418)	Daily	none	Braden ≤15, ≤18
Ramundo, 1995 ³⁷	Braden criteria (see Bergstrom 1987)	None; no adjusted analyses conducted	Unclear	17% (7/48)	On admission, then weekly	none	Braden ≤15, ≤18
Serpa, 2011 ³⁸	Method not described	None; no adjusted analyses conducted	Preventive measures given but not described	11% (8/72)	On admission and every 48 hours until development of PU, discharge from ICU or death; only patients with 3 consecutive assessments included in analysis	none	Braden ≤12, ≤13 Results stratified according to 1st, 2nd or 3rd assessment
Tourtual, 1997 ³⁹	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	Presence of pressure ulcer at baseline, incontinence, limb weakness, pulses, diagnosis of circulatory problem in lower extremity, diagnosis of CHF	Preventive measures given but not described	Study 2: 22% (63/291)	Daily	Logistic regression	Incidence of heel pressure ulcer only, Braden ≤12, ≤16

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Norton scale							
Bale, 1995 ¹	Torrance Developmental Classification of Pressure Sores: Stage 1: blanching erythema Stage 2: non-blanching erythema, superficial skin damage Stage 3: dermis ulceration Stage 4: ulceration extending to subcutaneous fat Stage 5: infective necrosis extending to muscle	None; no adjusted analyses conducted	All patients received preventive interventions, either mattress overlay (71%) or alternating pressure mattress (21%)	Phase 2: 3% (2/79)	Every other day until death or discharge	none	Modified Norton ≤10
Lincoln, 1986 ⁴⁰	5-point scale - 0: no skin change 1: erythema 2: superficial skin opening 3: lesion extending into underlying tissue 4: involvement of muscle and bone	None; no adjusted analyses conducted	Preventive measures given but not described	14% (5/36)	On admission, then every 3 days until discharge	none	Norton ≤14
Stotts, 1988 ⁴¹	Grade I: redness of skin without vesicle formation Grade II: excoriation, vesiculation or skin break Grade III: tissue disruption that extends into muscle Grade IV: ulcer through skin, fat and muscle extending to bone	None; no adjusted analyses conducted	Not reported	17% (67/387)	On admission, then every 3 days for up to 3 weeks	none	Modified Norton ≤14
Waterlow scale							
Compton, 2008 ⁴²	EPUAP - Grade 1: non-blanchable erythema Grade 2: partial-thickness skin loss or damage involving epidermis and/or dermis Grade 3: full-thickness skin loss with necrosis of epidermis or dermis Grade 4: full-thickness skin loss involving damage or necrosis of epidermis and/or dermis extending to the underlying bone, tendon or capsule	No adjusted analyses incorporating Waterlow score (used as a comparator)	Not reported	17% (121/698)	Unclear	Logistic regression for individual risk factors	Unclear cutoff

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Edwards, 1995 ⁴³	Torrance Developmental Classification of Pressure Sores: Stage I: blanching erythema Stage 2: non-blanching erythema, superficial skin damage Stage 3: Dermis ulceration Stage 4: Ulceration extending to subcutaneous fat Stage 5: Infective necrosis extending to muscle	None; no adjusted analyses conducted	Preventive measures in 10% (3/31) of patients	6% (2/31)	Unclear	none	Unclear cutoff
Serpa, 2009 ⁴⁴	Not described	None; no adjusted analyses conducted	Not reported	7% (7/98)	Every 48 hours	none	Waterlow ≥ 17 , ≥ 20
Webster, 2010 ⁴⁵	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Not reported	4% (12/274)	On admission, then every other day until development of pressure ulcer or discharge	none	Waterlow ≥ 15
Westrate, 1998 ⁴⁶	NPUAP staging- Stage 0: no redness or breakdown Stage I: non-blanching erythema Stage II: partial thickness skin loss involving epidermis or dermis Stage III: full thickness skin loss involving damage or necrosis of subcutaneous tissue Stage IV: full thickness skin loss extending to muscle or bone	None; no adjusted analyses conducted	Turning, nursing alternate sides of the bed at least 1 hour continuously, mobilizing patient from bed to standing or chair sitting	8% (47/594)	Daily	none	Waterlow ≥ 15
Other scales							
Andersen, 1982 ⁴⁷	Unclear; presence of bullae, black necrosis or skin defects indicated presence of pressure ulcer	None; no adjusted analyses conducted	Preventive measures given but not described	1% (40/3,398)	Every other day for 10 days	none	Risk assessment score cutoff 2

Author, year	Outcome Assessment Method	Risk Factor Adjustment	Interventions to Prevent Pressure Ulcers (n if reported)	Prevalence of Pressure Ulcers	Timing of risk Assessment	Type of Analysis	Analyzed by
Hatanaka, 2008 ⁴⁸	Pressure ulcers graded 1 (closed, persistent erythema) to 5	Age, Braden score, gender, laboratory values	All patients given standard pressure relieving mattress	26% (38/149)	Unclear	Logistic regression for individual risk factors	Novel indicator (combination of individual risk factors hemoglobin, CRP, albumin, age and gender) cutoff 0.28 (possible range 0-1)
Lindgren, 2002 ⁴⁹	Stage 1: persistent discoloration with intact skin surface Stage 2: epithelial damage (abrasion or blister) Stage 3: damage to the full thickness of the skin without a deep cavity Stage 4: damage to the full thickness of the skin with a deep cavity	None; no adjusted analyses conducted	Not reported	12% (62/530)		none	RPS \leq 36
Page, 2010 ⁵⁰	Unclear	No adjusted analyses relevant to TNH-PUPP	Not reported	4% (7/165)	Unclear	Univariate and multivariate logistic regression for individual risk factors	TNH-PUPP cutoff 3
Towey, 1988 ⁵¹	Unclear	None; no adjusted analyses conducted	Preventive measures given but not described	47% (28/60)	On admission, 14 days and 28 days later	none	Knoll cutoff 12

Author, year	True Positives (n)	False Negatives (n)	True Negatives (n)	False Positives (n)	Sensitivity	Specificity	PLR (95% CI)
Multiple scales							
Boyle, 2001 ⁴	Cubbin and Jackson: 23/28 Waterlow: 28/28	Cubbin and Jackson: 5/28 Waterlow: 0/28	Cubbin and Jackson: 213/506 Waterlow: 66/506	Cubbin and Jackson: 293/506 Waterlow: 440/506	Cubbin and Jackson: 0.83 Waterlow: 1.0	Cubbin and Jackson: 0.42 Waterlow: 0.13	Cubbin and Jackson: 0.08 Waterlow: 0.06
DeFoor, 2005 ⁵	<i>Nonblanchable erythema</i> - Braden 17: 290/363 Braden 18: 301/363 Norton 12: 225/363 Norton 14: 298/363 Clinical judgment: 269/363 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 148/187 Braden 18: 159/187 Norton 12: 123/187 Norton 14: 151/187 Clinical judgment: 77/187	<i>Nonblanchable erythema</i> - Braden 17: 73/363 Braden 18: 62/363 Norton 12: 138/363 Norton 14: 65/363 Clinical judgment: 94/363 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 39/187 Braden 18: 28/187 Norton 12: 64/187 Norton 14: 36/187 Clinical judgment: 110/187	<i>Nonblanchable erythema</i> - Braden 17: 916/1,409 Braden 18: 817/1,409 Norton 12: 1,014/1,409 Norton 14: 831/1,409 Clinical judgment: 705/1,409 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 951/1,585 Braden 18: 856/1,585 Norton 12: 1,094/1,585 Norton 14: 872/1,585 Clinical judgment: 1,411/1,585	<i>Nonblanchable erythema</i> - Braden 17: 493/1,409 Braden 18: 592/1,409 Norton 12: 395/1,409 Norton 14: 578/1,409 Clinical judgment: 704/1,409 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 634/1,585 Braden 18: 729/1,585 Norton 12: 491/1,585 Norton 14: 713/1,585 Clinical judgment: 174/1,585	<i>Nonblanchable erythema</i> - Braden 17: 0.8 Braden 18: 0.83 Norton 12: 0.62 Norton 14: 0.82 Clinical judgment: 0.74 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 0.79 Braden 18: 0.85 Norton 12: 0.66 Norton 14: 0.81 Clinical judgment: 0.41	<i>Nonblanchable erythema</i> - Braden 17: 0.65 Braden 18: 0.58 Norton 12: 0.72 Norton 14: 0.59 Clinical judgment: 0.5 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 0.6 Braden 18: 0.54 Norton 12: 0.69 Norton 14: 0.55 Clinical judgment: 0.89	<i>Nonblanchable erythema</i> - Braden 17: 0.57 Braden 18: 0.49 Norton 12: 0.55 Norton 14: 0.5 Clinical judgment: 0.37 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 0.24 Braden 18: 0.23 Norton 12: 0.26 Norton 14: 0.22 Clinical judgment: 0.46
Feuchtinger, 2007 ⁶	Braden 16: 20/26 Braden 20: 25/26 Modified Norton 21: 9/26 Modified Norton 23: 11/26 Modified Norton 25: 15/26 4-factor model: 22/26	Braden 16: 6/26 Braden 20: 1/26 Modified Norton 21: 17/26 Modified Norton 23: 15/26 Modified Norton 25: 11/26 4-factor model: 4/26	Braden 16: 8/27 Braden 20: 26/27 Modified Norton 21: 25/27 Modified Norton 23: 24/27 Modified Norton 25: 19/27 4-factor model: 8/27	Braden 16: 19/27 Braden 20: 1/27 Modified Norton 21: 2/27 Modified Norton 23: 3/27 Modified Norton 25: 8/27 4-factor model: 16/27	Braden 16: 0.78 Braden 20: 0.97 Modified Norton 21: 0.33 Modified Norton 23: 0.41 Modified Norton 25: 0.58 4-factor model: 0.85	Braden 16: 0.29 Braden 20: 0.05 Modified Norton 21: 0.94 Modified Norton 23: 0.88 Modified Norton 25: 0.47 4-factor model: 0.31	Braden 16: 0.7 [0.51] Braden 20: 0.69 [0.5] Modified Norton 21: 0.92 [0.84] Modified Norton 23: 0.88 [0.76] Modified Norton 25: 0.7 [0.65] 4-factor model: 0.7 [0.540]
Jalali, 2005 ⁷	Braden: 39/74 Gosnell: 63/74 Norton: 36/74 Waterlow: 47/74	Braden: 35/74 Gosnell: 11/74 Norton: 38/74 Waterlow: 27/74	Braden: 156/156 Gosnell: 129/156 Norton: 156/156 Waterlow: 129/156	Braden: 0/156 Gosnell: 27/156 Norton: 0/156 Waterlow: 27/156	Braden: 0.53 Gosnell: 0.85 Norton: 0.49 Waterlow: 0.63	Braden: 1.0 Gosnell: 0.83 Norton: 1.0 Waterlow: 0.83	Braden: ∞ Gosnell: 2.35 Norton: ∞ Waterlow: 1.74
Kim, 2009 ⁸	Braden: 37/40 Cubbin and Jackson: 38/40 Song/Choi: 38/40	Braden: 3/40 Cubbin and Jackson: 2/40 Song/Choi: 2/40	Braden: 125/179 Cubbin and Jackson: 147/179 Song/Choi: 124/179	Braden: 54/179 Cubbin and Jackson: 32/179 Song/Choi: 55/179	Braden: 0.93 Cubbin and Jackson: 0.95 Song/Choi: 0.95	Braden: 0.7 Cubbin and Jackson: 0.82 Song/Choi: 0.69	Braden: 0.68 Cubbin and Jackson: 1.15 Song/Choi: 0.67
Kwong, 2005 ⁹	Braden: 8/9 Modified Braden: 8/9 Norton: 8/9	Braden: 1/9 Modified Braden: 1/9 Norton: 1/9	Braden: 302/420 Modified Braden: 315/420 Norton: 256/420	Braden: 118/420 Modified Braden: 105/420 Norton: 164/420	Braden: 0.89 Modified Braden: 0.89 Norton: 0.89	Braden: 0.72 Modified Braden: 0.75 Norton: 0.61	Braden: 0.06 Modified Braden: 0.07 Norton: 0.05
Pang, 1998 ¹⁰	Braden: 19/21 Norton: 17/21 Waterlow: 20/21	Braden: 2/21 Norton: 4/21 Waterlow: 1/21	Braden: 53/85 Norton: 50/85 Waterlow: 37/85	Braden: 32/85 Norton: 35/85 Waterlow: 48/85	Braden: 0.91 Norton: 0.81 Waterlow: 0.95	Braden: 0.62 Norton: 0.59 Waterlow: 0.44	Braden: 0.6 Norton: 0.49 Waterlow: 0.42

Author, year	True Positives (n)	False Negatives (n)	True Negatives (n)	False Positives (n)	Sensitivity	Specificity	PLR (95% CI)
Perneger, 2002 ¹¹	Fragment: 113/182 Not calculable for Braden, Norton	Fragment: 69/182 Not calculable for Braden, Norton	Fragment: 857/1,190 Not calculable for Braden, Norton	Fragment: 151/1,190 Not calculable for Braden, Norton	Fragment: 0.62 Not calculable for Braden, Norton	Fragment: 0.85 Not calculable for Braden, Norton	Fragment: 0.73 Not calculable for Braden, Norton
Salvadarena, 1992 ¹²	Braden 15: 6/20 Braden 18: 12/20 Clinical judgment: 10/20	Braden 15: 14/20 Braden 18: 8/20 Clinical judgment: 10/20	Braden 15: 61/79 Braden 18: 43/79 Clinical judgment: 60/79	Braden 15: 18/79 Braden 18: 36/79 Clinical judgment: 16/79	Braden 15: 0.3 Braden 18: 0.6 Clinical judgment: 0.5	Braden 15: 0.77 Braden 18: 0.54 Clinical judgment: 0.79	Braden 15: 0.33 Braden 18: 0.33 Clinical judgment: 0.63
Schoonhoven, 2002 ¹³	Braden: 59/135 Norton: 62/135 Waterlow: 122/135	Braden: 76/135 Norton: 73/135 Waterlow: 13/135	Braden: 744/1094 Norton: 656/1094 Waterlow: 241/1094	Braden: 350/1094 Norton: 438/1094 Waterlow: 853/1094	Braden: 0.44 (0.35 to 0.52) Norton: 0.46 (0.38 to 0.55) Waterlow: 0.9 (0.84 to 0.95)	Braden: 0.68 (0.66 to 0.6) Norton: 0.6 (0.58 to 0.63) Waterlow: 0.22 (0.21 to 0.24)	Braden: 0.17 Norton: 0.14 Waterlow: 0.14
Seongsook, 2004 ¹⁴	Braden: 34/35 Cubbin/Jackson: 31/35 Douglas: 35/35	Braden: 1/35 Cubbin/Jackson: 4/35 Douglas: 0/35	Braden: 20/77 Cubbin/Jackson: 47/77 Douglas: 14/77	Braden: 57/77 Cubbin/Jackson: 30/77 Douglas: 63/77	Braden: 0.97 Cubbin/Jackson: 0.89 Douglas: 1.00	Braden: 0.26 Cubbin/Jackson: 0.61 Douglas: 0.18	Braden: 0.59 Cubbin/Jackson: 1.03 Douglas: 0.55
van Marum, 2000 ¹⁵	Not calculable	Not calculable	Not calculable	Not calculable	Norton: 0.75 Dutch CBO: 0.55	Norton: 0.55 Dutch CBO: 0.75	Not calculable
VandenBosch, 1996 ¹⁶	Braden: 17/29 Clinical judgment: 15/29	Braden: 12/29 Clinical judgment: 14/29	Braden: 44/74 Clinical judgment: 43/74	Braden: 30/74 Clinical judgment: 30/74	Braden: 0.59 Clinical judgment: 0.52	Braden: 0.41 Clinical judgment: 0.59	Braden: 0.39 Clinical judgment: 0.5
Wai-Han, 1997 ¹⁷	Norton: 6/8 Waterlow: 7/8	Norton: 2/8 Waterlow: 1/8	Norton: 120/177 Waterlow: 51/177	Norton: 57/177 Waterlow: 126/177	Norton: 0.75 Waterlow: 0.88	Norton: 0.68 Waterlow: 0.29	Norton: 0.11 Waterlow: 0.03
Braden scale							
Baldwin, 1998 ¹⁸	Braden 10: 10/11 Braden 15: 1/11	Braden 10: 1/11 Braden 15: 10/11	Braden 10: 24/36 Braden 15: 18/36	Braden 10: 1/46 Braden 15: 7/36	Braden 10: 0.91 Braden 15: 0.09	Braden 10: 0.96 Braden 15: 0.71	Braden 10: 10.2 Braden 15: 0.14
Barnes, 1993 ¹⁹	16/22	6/22	32/339	307/339	0.73	0.91	0.52
Bergstrom, 1987a ²⁰	Study 1: 7/7 Study 2: 9/9	Study 1: 0/7 Study 2: 0/9	Study 1: 83/92 Study 2: 58/91	Study 1: 9/92 Study 2: 6/91	Study 1: 1.0 Study 2: 1.0	Study 1: 0.9 Study 2: 0.64	Study 1: 0.75 Study 2: 0.27
Bergstrom, 1987b ²¹	Braden 15: 18/24 Braden 18: 22/24	Braden 15: 6/24 Braden 18: 2/24	Braden 15: 24/36 Braden 18: 14/36	Braden 15: 12/36 Braden 18: 22/36	Braden 15: 0.75 Braden 18: 0.92	Braden 15: 0.67 Braden 18: 0.39	Braden 15: 1.5 Braden 18: 1.0
Bergstrom, 1992 ²²	146/147	1/147	Not calculable	Not calculable	Not calculable	Not calculable	Not calculable

Author, year	True Positives (n)	False Negatives (n)	True Negatives (n)	False Positives (n)	Sensitivity	Specificity	PLR (95% CI)
Bergstrom, 1998 ²³ Other publications: Bergstrom, 2002 ²⁴	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 10/26 Braden 18: 10/26 <u>VA</u> Braden 15: 4/21 Braden 18: 6/21 <u>SNF</u> Braden 15: 19/61 Braden 18: 45/61 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 12/26 Braden 18: 23/26 <u>VA</u> Braden 15: 4/21 Braden 18: 13/21 <u>SNF</u> Braden 15: 20/61 Braden 18: 44/61	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 16/26 Braden 18: 16/26 <u>VA</u> Braden 15: 17/21 Braden 18: 15/21 <u>SNF</u> Braden 15: 42/61 Braden 18: 16/61 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 14/26 Braden 18: 3/26 <u>VA</u> Braden 15: 17/21 Braden 18: 8/21 <u>SNF</u> Braden 15: 41/61 Braden 18: 17/61	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 269/280 Braden 18: 221/280 <u>VA</u> Braden 15: 258/261 Braden 18: 235/261 <u>SNF</u> Braden 15: 182/194 Braden 18: 116/194 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 252/280 Braden 18: 190/280 <u>VA</u> Braden 15: 245/261 Braden 18: 211/261 <u>SNF</u> Braden 15: 180/194 Braden 18: 132/194	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 11/280 Braden 18: 59/280 <u>VA</u> Braden 15: 3/261 Braden 18: 26/261 <u>SNF</u> Braden 15: 12/194 Braden 18: 78/194 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 28/280 Braden 18: 90/280 <u>VA</u> Braden 15: 16/261 Braden 18: 50/261 <u>SNF</u> Braden 15: 14/194 Braden 18: 62/194	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 0.39 Braden 18: 0.38 <u>VA</u> Braden 15: 0.20 Braden 18: 0.30 <u>SNF</u> Braden 15: 0.31 Braden 18: 0.74 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 0.46 Braden 18: 0.88 <u>VA</u> Braden 15: 0.20 Braden 18: 0.60 <u>SNF</u> Braden 15: 0.33 Braden 18: 0.72	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 0.96 Braden 18: 0.79 <u>VA</u> Braden 15: 0.99 Braden 18: 0.90 <u>SNF</u> Braden 15: 0.94 Braden 18: 0.60 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 0.90 Braden 18: 0.68 <u>VA</u> Braden 15: 0.94 Braden 18: 0.81 <u>SNF</u> Braden 15: 0.93 Braden 18: 0.68	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 0.9 Braden 18: 0.17 <u>VA</u> Braden 15: 1.6 Braden 18: 0.24 <u>SNF</u> Braden 15: 1.63 Braden 18: 0.58 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 0.43 Braden 18: 0.26 <u>VA</u> Braden 15: 0.27 Braden 18: 0.25 <u>SNF</u> Braden 15: 1.48 Braden 18: 0.71
Bergstrom, 2002 ²⁴ Other publications: Bergstrom, 1998 ²³	Blacks - Braden 15: 3/8 Braden 18: 6/8 Whites - Braden 15: 31/98 Braden 18: 69/98	Blacks - Braden 15: 5/8 Braden 18: 2/8 Whites - Braden 15: 67/98 Braden 18: 29/98	Blacks - Braden 15: 140/151 Braden 18: 115/151 Whites - Braden 15: 536/564 Braden 18: 434/564	Blacks - Braden 15: 11/151 Braden 18: 36/151 Whites - Braden 15: 28/564 Braden 18: 130/564	Blacks - Braden 15: 0.38 Braden 18: 0.75 Whites - Braden 15: 0.32 Braden 18: 0.7	Blacks - Braden 15: 0.92 Braden 18: 0.76 Whites - Braden 15: 0.95 Braden 18: 0.77	Blacks - Braden 15: 0.25 Braden 18: 0.16 Whites - Braden 15: 1.13 Braden 18: 0.54
Braden, 1994 ²⁵	Braden 15: 12/28 Braden 18: 22/28	Braden 15: 16/28 Braden 18: 6/28	Braden 15: 70/74 Braden 18: 50/74	Braden 15: 4/74 Braden 18: 24/74	Braden 15: 0.32 Braden 18: 0.79	Braden 15: 0.95 Braden 18: 0.74	Braden 15: 2.49 Braden 18: 0.94
Capobianco, 1996 ²⁶	10/14	4/14	30/36	6/36	0.71	0.83	1.62
Chan, 2005 ²⁷	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Chan, 2009 ²⁸	Braden: 12/18 Modified Braden: 16/18	Braden: 6/18 Modified Braden: 2/18	Braden: 115/179 Modified Braden: 111/197	Braden: 64/179 Modified Braden: 68/197	Braden: 0.67 Modified Braden: 0.89	Braden: 0.64 Modified Braden: 0.62	Braden: 0.18 Modified Braden: 0.23
Goodridge, 1998 ²⁹	Braden 15: 3/32 Braden 18: 15/32	Braden 15: 29/32 Braden 18: 17/32	Braden 15: 271/298 Braden 18: 203/298	Braden 15: 27/298 Braden 18: 95/298	Braden 15: 0.09 Braden 18: 0.47	Braden 15: 0.91 Braden 18: 0.68	Braden 15: 0.11 Braden 18: 0.16
Hagisawa, 1999 ³⁰	14/36	22/36	239/239	0/239	0.39	1.0	∞
Halfens, 2000 ³¹	Braden 15: 10/47 Braden 18: 24/47 Extended Braden 15: 3/47 Extended Braden 18: 11/47	Braden 15: 37/47 Braden 18: 23/47 Extended Braden 15: 44/47 Extended Braden 18: 36/47	Braden 15: 259/273 Braden 18: 235/273 Extended Braden 15: 270/273 Extended Braden 18: 259/273	Braden 15: 14/273 Braden 18: 38/273 Extended Braden 15: 3/273 Extended Braden 18: 14/273	Braden 15: 0.22 Braden 18: 0.51 Extended Braden 15: 0.07 Extended Braden 18: 0.24	Braden 15: 0.95 Braden 18: 0.86 Extended Braden 15: 0.99 Extended Braden 18: 0.95	Braden 15: 0.76 Braden 18: 0.63 Extended Braden 15: 1.21 Extended Braden 18: 0.83

Author, year	True Positives (n)	False Negatives (n)	True Negatives (n)	False Positives (n)	Sensitivity	Specificity	PLR (95% CI)
Langemo, 1991 ³²	Braden 15: 6/11 Braden 18: 4/7	Braden 15: 5/11 Braden 18: 3/7	Braden 15: 59/63 Braden 18: 11/18	Braden 15: 4/63 Braden 18: 7/18	Braden 15: 0.55 Braden 18: 0.57	Braden 15: 0.94 Braden 18: 0.61	Braden 15: 1.62 Braden 18: 0.57
Lewicki, 2000 ³³	<i>POD 1</i> Braden 15: 11/16 Braden 18: no data <i>POD 3</i> Braden 15: 9/16 Braden 18: 9/16 <i>POD 5</i> Braden 15: 5/16 Braden 18: 5/16	<i>POD 1</i> Braden 15: 5/16 Braden 18: no data <i>POD 3</i> Braden 15: 7/16 Braden 18: 7/16 <i>POD 5</i> Braden 15: 11/16 Braden 18: 11/16	<i>POD 1</i> Braden 15: 35/321 Braden 18: no data <i>POD 3</i> Braden 15: 289/321 Braden 18: 257/321 <i>POD 5</i> Braden 15: 295/321 Braden 18: 273/321	<i>POD 1</i> Braden 15: 286 Braden 18: no data <i>POD 3</i> Braden 15: 32 Braden 18: 64 <i>POD 5</i> Braden 15: 26 Braden 18: 48	<i>POD 1</i> Braden 15: 0.67 Braden 18: no data <i>POD 3</i> Braden 15: 0.57 Braden 18: 0.57 <i>POD 5</i> Braden 15: 0.33 Braden 18: 0.33	<i>POD 1</i> Braden 15: 0.11 Braden 18: no data <i>POD 3</i> Braden 15: 0.9 Braden 18: 0.8 <i>POD 5</i> Braden 15: 0.92 Braden 18: 0.85	<i>POD 1</i> Braden 15: 0.04 Braden 18: no data <i>POD 3</i> Braden 15: 0.29 Braden 18: 0.14 <i>POD 5</i> Braden 15: 0.19 Braden 18: 0.11
Lyder, 1998 ³⁴	5/14	9/14	22/22	0/22	0.35	1.0	∞
Lyder, 1999 ³⁵	Not calculable	Not calculable	Not calculable	Not calculable	Braden 16 (blacks): 0.77 Braden 16 (Hispanics): 0.9 Braden 18 (blacks): 0.81	Braden 16 (blacks): 0.5 Braden 16 (Hispanics): 0.14 Braden 18 (blacks): 1	Not calculable
Olson, 1998 ³⁶	Study 1 - Braden 15: 9/11 Braden 18: 10/11 Study 2 - Braden 15: 18/43 Braden 18: 31/43	Study 1 - Braden 15: 2/11 Braden 18: 1/11 Study 2 - Braden 15: 25/43 Braden 18: 12/43	Study 1 - Braden 15: 103/117 Braden 18: 83/117 Study 2 - Braden 15: 338/375 Braden 18: 266/375	Study 1 - Braden 15: 14/117 Braden 18: 34/117 Study 2 - Braden 15: 37/375 Braden 18: 109/375	Study 1 - Braden 15: 0.82 Braden 18: 0.91 Study 2 - Braden 15: 0.42 Braden 18: 0.72	Study 1 - Braden 15: 0.88 Braden 18: 0.71 Study 2 - Braden 15: 0.9 Braden 18: 0.71	Study 1 - Braden 15: 0.68 Braden 18: 0.31 Study 2 - Braden 15: 0.47 Braden 18: 0.28
Ramundo, 1995 ³⁷	Braden 15: 6/7 Braden 18: 7/7	Braden 15: 1/7 Braden 18: 0/7	Braden 15: 34/41 Braden 18: 14/41	Braden 15: 7/41 Braden 18: 27/41	Braden 15: 0.14 Braden 18: 1.0	Braden 15: 0.83 Braden 18: 0.34	Braden 15: 0.17 Braden 18: 0.31
Serpa, 2011 ³⁸	Braden 12; 1st assessment: 7/8 Braden 13; 2nd assessment: 6/8 Braden 13; 3rd assessment: 6/8	Braden 12; 1st assessment: 1/8 Braden 13; 2nd assessment: 2/8 Braden 13; 3rd assessment: 2/8	Braden 12; 1st assessment: 42/64 Braden 13; 2nd assessment: 52/64 Braden 13; 3rd assessment: 53/64	Braden 12; 1st assessment: 22/64 Braden 13; 2nd assessment: 12/64 Braden 13; 3rd assessment: 11/64	Braden 12; 1st assessment: 0.86 Braden 13; 2nd assessment: 0.71 Braden 13; 3rd assessment: 0.71	Braden 12; 1st assessment: 0.65 Braden 13; 2nd assessment: 0.82 Braden 13; 3rd assessment: 0.83	Braden 12; 1st assessment: 2.42 (1.55 to 3.79) Braden 13; 2nd assessment: 3.87 (1.93 to 7.74) Braden 13; 3rd assessment: 4.22 (2.07 to 8.62)
Tourtual, 1997 ³⁹	Braden 12: 9/63 Braden 16: 31/63	Braden 12: 54/63 Braden 16: 32/63	Braden 12: 214/228 Braden 16: 173/228	Braden 12: 14/228 Braden 16: 55/228	Braden 12: 0.14 Braden 16: 0.49	Braden 12: 0.94 Braden 16: 0.76	Braden 12: 0.66 Braden 16: 0.58
Norton scale							
Bale, 1995 ¹	2/55	53/55	24/24	0/24	1.0	0.31	0.04
Lincoln, 1986 ⁴⁰	0/2	2/2	29/34	5/34	0.0	0.85	0.0
Stotts, 1988 ⁵³	11/67	56/67	305/320	15/320	0.16	0.95	0.67

Author, year	True Positives (n)	False Negatives (n)	True Negatives (n)	False Positives (n)	Sensitivity	Specificity	PLR (95% CI)
Waterlow scale							
Compton, 2008 ⁴²	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Edwards, 1995 ⁴³	2/2	0/2	3/29	26/29	1.0	0.1	0.07
Serpa, 2009 ⁴⁴	Waterlow 17, 1st assessment: 5/7 Waterlow 20, 2nd assessment: 6/7 Waterlow 20, 3rd assessment: 6/7	Waterlow 17, 1st assessment: 2/7 Waterlow 20, 2nd assessment: 1/7 Waterlow 20, 3rd assessment: 1/7	Waterlow 17, 1st assessment: 61/91 Waterlow 20, 2nd assessment: 37/91 Waterlow 20, 3rd assessment: 30/91	Waterlow 17, 1st assessment: 30/91 Waterlow 20, 2nd assessment: 54/91 Waterlow 20, 3rd assessment: 61/91	Waterlow 17, 1st assessment: 0.71 Waterlow 20, 2nd assessment: 0.86 Waterlow 20, 3rd assessment: 0.86	Waterlow 17, 1st assessment: 0.67 Waterlow 20, 2nd assessment: 0.41 Waterlow 20, 3rd assessment: 0.33	Waterlow 17, 1st assessment: 2.17 (CI 1.25 to 3.77) Waterlow 20, 2nd assessment: 1.44 (CI 1.02 to 2.04) Waterlow 20, 3rd assessment: 1.28 (CI 0.91 to 1.79)
Webster, 2010 ⁴⁵	6/45	39/45	152/155	3/155	0.67	0.79	0.15
Westrate, 1998 ⁴⁶	38/47	9/47	156/547	391/547	0.81	0.29	0.1
Other scales							
Andersen, 1982 ⁴⁷	35/40	5/40	2,911/3,358	447/3,358	0.88	0.87	0.08
Hatanaka, 2008 ⁴⁸	28/38	10/38	78/111	33/111	0.73	0.7	0.85
Lindgren, 2002 ⁴⁹	35/62	27/62	271/468	197/468	0.57	0.58	0.19
Page, 2011 ⁵⁰	6/7	1/7	115/158	43/158	0.86 (0.42. to 1.0)	0.73 (0.66 to 0.8)	0.13
Towey, 1988 ⁵¹	24/28	4/28	18/32	14/32	0.86	0.56	1.71

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Multiple scales								
Boyle, 2001 ⁴	Cubbin and Jackson: 0.02 Waterlow: 0.0	Cubbin and Jackson: 0.07 Waterlow: 0.06	Cubbin and Jackson: 0.98 Waterlow: 1.0	Not reported	Cubbin and Jackson: 0.72 Waterlow: 0.66	PLR, NLR, PPV, NPV calculated based on data in text	Fair	
DeFloor, 2005 ⁵	<i>Nonblanchable erythema</i> - Braden 17: 0.08 Braden 18: 0.07 Norton 12: 0.13 Norton 14: 0.08 Clinical judgment: 0.13 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 0.04 Braden 18: 0.03 Norton 12: 0.06 Norton 14: 0.04 Clinical judgment: 0.08	<i>Nonblanchable erythema</i> - Braden 17: 0.36 Braden 18: 0.33 Norton 12: 0.36 Norton 14: 0.33 Clinical judgment: 0.27 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 0.2 Braden 18: 0.19 Norton 12: 0.21 Norton 14: 0.18 Clinical judgment: 0.32	<i>Nonblanchable erythema</i> - Braden 17: 0.93 Braden 18: 0.93 Norton 12: 0.88 Norton 14: 0.67 Clinical judgment: 0.73 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 0.96 Braden 18: 0.97 Norton 12: 0.94 Norton 14: 0.96 Clinical judgment: 0.92	<i>Nonblanchable erythema</i> - Braden 17: 7.22 Braden 18: 6.86 Norton 12: 4.2 Norton 14: 6.58 Clinical judgment: 2.83 <i>Grade 2 or higher pressure ulcer</i> - Braden 17: 5.62 Braden 18: 6.94 Norton 12: 4.3 Norton 14: 5.34 Clinical judgment: 5.77	<i>Nonblanchable erythema</i> - Braden: 0.77 Norton: 0.75 <i>Grade 2 or higher pressure ulcer</i> - Braden: 0.75 Norton: 0.74 No data for clinical judgment		Fair	
Feuchtinger, 2007 ⁶	Braden 16: 0.76 Braden 20: 0.58 Modified Norton 21: 0.68 Modified Norton 23: 0.64 Modified Norton 25: 0.58 4-factor model: 0.46	Braden 16: 0.7 [0.51] Braden 20: 0.69 [0.5] Modified Norton 21: 0.92 [0.84] Modified Norton 23: 0.88 [0.76] Modified Norton 25: 0.7 [0.65] 4-factor model: 0.7 [0.540]	Braden 16: 0.38 [0.58] Braden 20: 0.5 [0.63] Modified Norton 21: 0.4 [0.59] Modified Norton 23: 0.42 [0.61] Modified Norton 25: 0.35 [0.63] 4-factor model: 0.38 [0.68]	Not reported	Not reported	Not reported	Fair	
Jalali, 2005 ⁷	Braden: 0.22 Gosnell: 0.09 Norton: 0.24 Waterlow: 0.21	Braden: 1.0 Gosnell: 0.59 [0.7] Norton: 1.0 Waterlow: 0.61 [0.64]	Braden: 0.58 [0.82] Gosnell: 0.95 [0.92] Norton: 0.52 [0.81] Waterlow: 0.84 [0.83]	Not reported	Not reported	Youden's index (measures diagnostic value; values range from -1 to 1; J=0 indicates no diagnostic value) Braden: 0.53 Gosnell: 0.68 Norton: 0.49 Waterlow: 0.47	Fair	

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Kim, 2009 ⁸	Braden: 0.02 Cubbin and Jackson: 0.01 Song/Choi: 0.02	Braden: 0.41 Cubbin and Jackson: 0.56 [0.54] Song/Choi: 0.41 [0.4]	Braden: 0.98 Cubbin and Jackson: 0.99 Song/Choi: 0.98	Not reported	Braden: 0.881 Cubbin and Jackson: 0.902 Song/Choi: 0.89	73% of patients that developed a PU used artificial respirator	Fair	
Kwong, 2005 ⁹	Braden: 0.003 Modified Braden: 0.001 Norton: 0.004	Braden: 0.05 [0.06] Modified Braden: 0.07 Norton: 0.05	Braden: 1.0 Modified Braden: 1.0 Norton: 1.0	Not reported	Not reported		Good	
Pang, 1998 ¹⁰	Braden: 0.04 Norton: 0.08 Waterlow: 0.03	Braden: 0.37 Norton: 0.33 Waterlow: 0.29 [0.3]	Braden: 0.96 Norton: 0.97 [0.93] Waterlow: 0.93 [0.97]	Not reported	Not reported	Not reported	Good	
Perneger, 2002 ¹¹	Fragmment: 0.08 Not calculable for Braden, Norton	Fragmment: 0.34 [0.42] Not calculable for Braden, Norton	Fragmment: 0.95 [0.93] Not calculable for Braden, Norton	Fragmment: RR 1.6 (CI 1.4 to 1.7) per 1 point increase in score	Fragmment: 0.79 (CI 0.75 to 0.82) Braden: 0.74 (CI 0.70 to 0.78; p=0.004 vs. Fraggmment) Norton: 0.74 (CI 0.70 to 0.78; p=0.006 vs. Fraggmment)	Fragmment + preventive measures: HR 1.3 (CI 1.2 to 1.5) per one-point difference Fragmment score + no preventive measures: HR 1.7 (CI 1.6 to 1.9) per one-point difference Unadjusted HR/1 SD increase from baseline: Braden: range 2.4 (for days 0-2) to 1.0 (Day ≥11) Norton: range 2.3 (days 0-2) to 1.1 (Day ≥11)	Fair	
Salvadarena, 1992 ¹²	Braden 15: 0.23 Braden 18: 0.19 Clinical judgment: 0.17	Braden 15: 0.25 Braden 18: 0.25 Clinical judgment: 0.39	Braden 15: 0.81 Braden 18: 0.84 Clinical judgment: 0.86	Not reported	Not reported		Fair	

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Schoonhoven, 2002 ¹³	Braden: 0.12 Norton: 0.11 Waterlow: 0.06	Braden: 0.08 (0.06 to 0.1) [0.15] Norton: 0.07 (0.06 to 0.09) [0.12] Waterlow: 0.07 (0.06 to 0.08) [0.12]	Braden: 0.95 (0.94 to 0.96) [0.91] Norton: 0.95 (0.93 to 0.96) [0.89] Waterlow: 0.98 (0.95 to 0.99) [0.95]	Not reported	Braden: 0.55 (0.49 to 0.6) Norton: 0.56 (0.51 to 0.61) Waterlow: 0.61 (0.56 to 0.66)		Good	
Seongsook, 2004 ¹⁴	Braden: 0.05 Cubbin/Jackson: 0.08 Douglas: 0.0	Braden: 0.37 Cubbin/Jackson: 0.51 Douglas: 0.34	Braden: 0.95 Cubbin/Jackson: 0.92 Douglas: 1.00	Not reported	Braden: 0.707 Cubbin/Jackson: 0.826 Douglas: 0.791	Not reported	Good	
van Marum, 2000 ¹⁵	Not calculable	Not calculable	Not calculable	Not reported	Not reported	CBO data for 220/267 patients with Norton data	Fair	
VandenBosch, 1996 ⁵²	Braden: 0.39 Clinical judgment: 0.33	Braden: 0.28 Clinical judgment: 0.33	Braden: 0.72 Clinical judgment: 0.75	Not reported	Not reported		Good	
Wai-Han, 1997 ¹⁷	Norton: 0.02 Waterlow: 0.02	Norton: 0.01 Waterlow: 0.05	Norton: 0.98 Waterlow: 0.98	Not reported	Not reported		Fair	
Braden scale								
Baldwin, 1998 ¹⁸	Braden 10: 0.04 Braden 15: 0.58	Braden 10: 0.91 Braden 15: 0.12	Braden 10: 0.96 Braden 15: 0.63	Not reported	Not reported	Other Braden cutoffs also evaluated, ranging from 9-16 PLR, NLR, PPV, NPV calculated from reported data	Fair	
Barnes, 1993 ¹⁹	0.02	0.34	0.98	Not reported	Not reported	Not reported	Fair	
Bergstrom, 1987a ²⁰	Study 1: 0 Study 2: 0	Study 1: 0.43 Study 2: 0.23	Study 1: 1.0 Study 2: 1.0	Not reported	Not reported		Good	
Bergstrom, 1987b ²¹	Braden 15: 0.25 Braden 18: 0.14	Braden 15: 0.6 Braden 18: 0.5	Braden 15: 0.8 Braden 18: 0.88	Not reported	Not reported	Other Braden cutoffs also evaluated, ranging from 9-22	Good	
Bergstrom, 1992 ²²	Not calculable	Not calculable	Not calculable	Not reported	Not reported		Good	

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Bergstrom, 1998 ²³ Other publications: Bergstrom, 2002 ²⁴	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 0.06 Braden 18: 0.07 <u>VA</u> Braden 15: 0.06 Braden 18: 0.06 <u>SNF</u> Braden 15: 0.23 Braden 18: 0.12 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 0.06 Braden 18: 0.02 <u>VA</u> Braden 15: 0.07 Braden 18: 0.04 <u>SNF</u> Braden 15: 0.23 Braden 18: 0.13	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 0.40 [0.48] Braden 18: 0.14 <u>VA</u> Braden 15: 0.60 [0.62] Braden 18: 0.19 <u>SNF</u> Braden 15: 0.61 [0.62] Braden 18: 0.37 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 0.31 [0.30] Braden 18: 0.21 <u>VA</u> Braden 15: 0.20 [0.21] Braden 18: 0.18 [0.2] <u>SNF</u> Braden 15: 0.61 [0.6] Braden 18: 0.42 [0.41]	<i>Time 1:</i> <u>Tertiary care</u> Braden 15: 0.94 Braden 18: 0.93 <u>VA</u> Braden 15 0.94 Braden 18: 0.94 <u>SNF</u> Braden 15: 0.81 Braden 18: 0.88 <i>Time 2:</i> <u>Tertiary care</u> Braden 15: 0.94 [0.95] Braden 18: 0.93 [0.98] <u>VA</u> Braden 15 0.94 Braden 18: 0.96 <u>SNF</u> Braden 15: 0.81 [0.82] Braden 18: 0.88 [0.89]	Not reported	Not reported	Other Braden cutoffs also evaluated	Fair	
Bergstrom, 2002 ²⁴ Other publications: Bergstrom, 1998 ²³	Blacks - Braden 15: 0.04 Braden 18: 0.02 Whites - Braden 15: 0.13 Braden 18: 0.07	Blacks - Braden 15: 0.23 Braden 18: 0.17 [0.14] Whites - Braden 15: 0.57 [0.53] Braden 18: 0.41 [0.35]	Blacks - Braden 15: 0.96 Braden 18: 0.98 Whites - Braden 15: 0.86 [0.89] Braden 18: 0.92 [0.94]	Blacks - OR 2.06; p=0.03 Whites - OR 1.3; p=0.0001	Blacks - 0.82 (SE 0.07) Whites - 0.75 (SE 0.03)	Other cutoffs also evaluated, ranging from 6-23	Fair	
Braden, 1994 ²⁵	Braden 15: 0.28 Braden 18: 0.12	Braden 15: 0.69 [0.71] Braden 18: 0.54	Braden 15: 0.79 [0.78] Braden 18: 0.9	Not reported	Not reported		Fair	
Capobianco, 1996 ²⁶	0.14	0.63 [0.62]	0.88	Not reported	Not reported	None reported	Good	

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Chan, 2005 ²⁷	Not reported	Not reported	Not reported	Moderate risk vs. low risk: OR 7.7 (CI 3.5 to 17.1) High-risk vs. low-risk: OR 12.5 (CI 4.5-34.6)	Not reported	Mean Braden score in patients with ulcers (54/666) 14 vs. patients without ulcers (612/666) 19	Fair	
Chan, 2009 ²⁸	Braden: 0.05 Modified Braden: 0.02	Braden: 0.16 Modified Braden: 0.19	Braden: 0.95 Modified Braden: 0.98	Not reported	Braden: 0.68 (CI 0.51 to 0.79) Modified Braden: 0.74 (CI 0.63 to 0.84)	PLR, NLR, PPV, NPV calculated from data in text	Fair	
Goodridge, 1998 ²⁹	Braden 15: 0.11 Braden 18: 0.09	Braden 15: 0.10 Braden 18: 0.14	Braden 15: 0.90 Braden 18: 0.92	Not reported	Not reported	Sensitivity, specificity, PPV and NPV reported for Braden scores 11-20	Fair	
Hagisawa, 1999 ³⁰	0.09	1.0	0.92	Not reported	Not reported		Fair	
Halfens, 2000 ³¹	Braden 15: 0.14 Braden 18: 0.1 Extended Braden 15: 0.16 Extended Braden 18: 0.14	Braden 15: 0.43 Braden 18: 0.39 Extended Braden 15: 0.55 Extended Braden 18: 0.45	Braden 15: 0.88 Braden 18: 0.91 Extended Braden 15: 0.86 Extended Braden 18: 0.88	OR 3.0 (1.8 to 5.0)	Not reported	Unclear comparison used in OR calculation PPV, NPV, PLR, NLR not reported in text - values calculated	Fair	
Langemo, 1991 ³²	Braden 15: 0.08 Braden 18: 0.27	Braden 15: 0.62 Braden 18: 0.36	Braden 15: 0.92 Braden 18: 0.78	Not reported	Not reported	No pressure ulcers developed in rehab, home care or hospice patients; estimated ideal cutoffs were 18, 20 and 18, respectively	Good	
Lewicki, 2000 ³³	<i>POD 1</i> Braden 15: 0.15 Braden 18: no data <i>POD 3</i> Braden 15: 0.02 Braden 18: 0.03 <i>POD 5</i> Braden 15: 0.04 Braden 18: 0.04	<i>POD 1</i> Braden 15: 0.03 Braden 18: no data <i>POD 3</i> Braden 15: 0.22 Braden 18: 0.12 <i>POD 5</i> Braden 15: 0.16 Braden 18: 0.1	<i>POD 1</i> Braden 15: 0.87 Braden 18: no data <i>POD 3</i> Braden 15: 0.98 Braden 18: 0.97 <i>POD 5</i> Braden 15: 0.97 Braden 18: 0.96	Not reported	Not reported	Other Braden cutoffs also evaluated	Good	

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Lyder, 1998 ³⁴	0.41	1.0	0.71	Not reported	Not reported	PLR, NLR, PPV, NPV calculated from data in text	Good	
Lyder, 1999 ³⁵	Not calculable	Braden 16 (blacks): 0.77 Braden 16 (Hispanics): 0.6 Braden 18: 1	Braden 16 (blacks): 0.6 Braden 16 (Hispanics): 0.5 Braden 18: 0.5	Not reported	Not reported		Good	
Olson, 1998 ³⁶	Study 1 - Braden 15: 0.02 Braden 18: 0.01 Study 2 - Braden 15: 0.07 Braden 18: 0.04	Study 1 - Braden 15: 0.4 Braden 18: 0.24 Study 2 - Braden 15: 0.32 Braden 18: 0.22	Study 1 - Braden 15: 0.98 Braden 18: 0.99 Study 2 - Braden 15: 0.93 Braden 18: 0.96	Not reported	Not reported	Other Braden cutoffs also evaluated, ranging from 12-20 PLR, NLR, PPV, NPV calculated from data in text	Fair	Poor quality; results are outliers
Ramundo, 1995 ³⁷	Braden 15: 0.21 Braden 18: 0.0	Braden 15: 0.14 Braden 18: 0.24	Braden 15: 0.82 Braden 18: 1.0	Not reported	Not reported		Poor	
Serpa, 2011 ³⁸	Braden 12; 1st assessment: 0.22 (0.04 to 1.37) Braden 13; 2nd assessment: 0.35 (0.11 to 1.14) Braden 13; 3rd assessment: 0.34 (0.11 to 1.12)	Braden 12; 1st assessment: 0.21 [0.23] Braden 13; 2nd assessment: 0.29 [0.33] Braden 13; 3rd assessment: 0.31 [0.34]	Braden 12; 1st assessment: 0.98 Braden 13; 2nd assessment: 0.96 Braden 13; 3rd assessment: 0.96	Not reported	Braden 12; 1st assessment: 0.79 (0.29 to 1.0) Braden 13; 2nd assessment: 0.79 (0.27 to 1.0) Braden 13; 3rd assessment: 0.8 (0.28 to 1.0)	PLR, NLR reported in text	Fair	
Tourtual, 1997 ³⁹	Braden 12: 0.26 Braden 16: 0.19	Braden 12: 0.4 Braden 16: 0.37	Braden 12: 0.79 Braden 16: 0.84	Not reported for Braden (RRs for individual risk factors reported)	Not reported	Results from Study 1 not included; prevalence of pressure ulcers at baseline 14% PLR, NLR, PPV and NPV calculated from data in text	Poor	
Norton scale								
Bale, 1995 ¹	0	0.04	1.0	Not reported	Not reported	Sensitivity, specificity, PLR, NLR, PPV, NPV calculated from reported data	Fair	
Lincoln, 1986 ⁴⁰	0.07	0.0	0.94	Not reported	Not reported	Sensitivity, specificity, PLR, NLR, PPV, NPV calculated from reported data	Fair	

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Stotts, 1988 ⁴¹	0.18	0.4	0.85	Not reported	Not reported	Sensitivity, specificity, PLR, NLR, PPV, NPV calculated from reported data	Fair	
Waterlow scale								
Compton, 2008 ⁴²	Not reported	Not reported	Not reported	Not reported	0.58 (CI 0.54 to 0.65)	Other results not reported	Fair	
Edwards, 1995 ⁴³	0.0	0.07	1.0				Fair	
Serpa, 2009 ⁴⁴	Waterlow 17, 1st assessment: 0.43 (CI 0.13 to 1.39) Waterlow 20, 2nd assessment: 0.35 (CI 0.06 to 2.19) Waterlow 20, 3rd assessment: 0.43 (0.07 to 2.72)	Waterlow 17, 1st assessment: 0.14 Waterlow 20, 2nd assessment: 0.1 Waterlow 20, 3rd assessment: 0.9	Waterlow 17, 1st assessment: 0.97 Waterlow 20, 2nd assessment: 0.97 Waterlow 20, 3rd assessment: 0.97	Not reported	Waterlow 17, 1st assessment: 0.64 (CI 0.35 to 0.93) Waterlow 20, 2nd assessment: 0.59 (CI 0.34 to 0.83) Waterlow 20, 3rd assessment: 0.54 (0.35 to 0.74)	PLR, NLR, PPV, NPV reported in text	Fair	
Webster, 2010 ⁴⁵	0.02	0.13 (0.07 to 0.24)	0.98 (0.94 to 0.99)	5.37 (1.76 to 16.42) (unadjusted)	Not reported	Mean length of stay: 8.8 vs. 9.4 vs. 8.5 days	Fair	
Westrate, 1998 ⁴⁶	0.06	0.09	0.95	Not reported	Not reported	Sensitivity, specificity, PLR, NLR, PPV, NPV calculated from data in text	Fair	
Other scales								
Andersen, 1982 ⁴⁷	0.02	0.07	1.0	Not reported	Not reported	PLR, NLR, PPV, NPV calculated from data in text	Fair	
Hatanaka, 2008 ⁴⁸	0.14	0.46	0.88	Not reported	Novel indicator: 0.79 Braden: 0.56	Sensitivity, specificity for Braden score not reported PLR, NLR, PPV, NPV calculated from data in text	Fair	
Lindgren, 2002 ⁴⁹	0.10	0.14 [0.16]	0.92 [0.91]	Not reported	Not reported	None reported	Poor	

Author, year	NLR (95% CI)	PPV (calculated value, if different from reported value)	NPV (calculated value, if different from reported value)	OR (95% CI)	Area under ROC (95% CI)	Other Results/Comments	Quality Rating	Comments
Page, 2010 ³⁰	0.01	0.13 (0.05 to 0.25) [0.12]	0.99 (0.95 to 1.0)	Not reported	0.9 (CI 0.82 to 0.99)	An unclear proportion of patients may have had pressure ulcers at baseline, though these results are not included in the report	Fair	
Towey, 1988 ³¹	0.22	0.63	0.82	Not reported	Not reported		Fair	

Appendix H5. Key Question 2: Quality Assessment of Pressure Ulcer Risk Assessment Scales

Author, year	Representative spectrum?	Evaluated a population other than the one used to derive the screening instrument?	Random or consecutive sample?	Study reported that groups received comparable interventions?	Test cutoffs predefined?	Credible reference standard?	Reference standard applied to all patients, or a random subset?	Low attrition?	Same reference standard applied to all patients?	Blinding: Reference standard interpreted independently from test under evaluation?	Quality Rating
Andersen, 1982 ⁴⁷	Yes	No	Unclear	No	No	Unclear	Yes	Yes	Yes	Unclear	Poor
Baldwin, 1998 ¹⁸	Yes	Yes	Unclear	No	No	Yes	Yes	Yes	Yes	Yes	Fair
Bale, 1995 ¹	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Fair
Barnes, 1993 ¹⁹	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Unclear	Fair
Bergstrom, 1987a ²⁰	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Unclear	Good
Bergstrom, 1987b ²¹	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Good
Bergstrom, 1992 ²²	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Good
Bergstrom, 2002 ²⁴ Other publications: Bergstrom, 1998 ²³	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Fair
Bergstrom, 1998 ²³ Other publications: Bergstrom, 2002 ²⁴	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Unclear	Fair
Boyle, 2001 ⁴	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Fair
Braden, 1994 ²⁵	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Fair
Capobianco, 1996 ²⁶	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Good
Chan, 2005 ²⁷	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Unclear	Fair
Chan 2009 ²⁸	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Fair
Compton, 2008 ⁴²	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Unclear	Fair
DeFloor, 2005 ⁵	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Yes	Fair
Edwards, 1995 ⁴³	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Fair
Feuchtinger, 2007 ⁶	Yes	Yes, for 2/3 scales	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Fair

Author, year	Representative spectrum?	Evaluated a population other than the one used to derive the screening instrument?	Random or consecutive sample?	Study reported that groups received comparable interventions?	Test cutoffs predefined?	Credible reference standard?	Reference standard applied to all patients, or a random subset?	Low attrition?	Same reference standard applied to all patients?	Blinding: Reference standard interpreted independently from test under evaluation?	Quality Rating
Goodridge, 1998 ²⁹	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Fair
Hagisawa, 1999 ³⁰	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Unclear	Fair
Halfens, 2000 ³¹	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Fair
Hatanaka, 2008 ⁴⁸	Yes	No	Unclear	Yes	No	Unclear	Yes	Yes	Yes	Unclear	Fair
Jalali, 2005 ⁷	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Unclear	Fair
Kim, 2009 ⁸	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Unclear	Fair
Kwong, 2005 ⁹	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Good
Langemo, 1991 ³²	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Good
Lewicki, 2000 ³³	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Good
Lincoln, 1986 ⁴⁰	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Yes	Fair
Lindgren, 2002 ³⁹	Yes	No	Unclear	No	No	Yes	Yes	No	Yes	Unclear	Poor
Lyder, 1998 ³⁴	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Good
Lyder, 1999 ³⁵	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Good
Olson, 1998 ³⁶	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Fair
Page, 2011 ⁵⁰	Yes	Yes (validity results)	Unclear	No	No	Unclear	Yes	Yes	Yes	Unclear	Fair
Pang, 1998 ¹⁰	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Unclear	Good
Perneger, 2002 ¹¹	Yes	No (for Fragment scale)	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Fair
Ramundo, 1995 ³⁷	Unclear	Yes	Unclear	No	No	Yes	Yes	Yes	Yes	No	Poor
Salvadarena, 1992 ¹²	Yes	Yes	Unclear	No	No	Yes	Yes	Yes	Yes	Yes	Fair
Schoonhoven, 2002 ¹³	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good
Seongsook, 2004 ¹⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Good
Serpa, 2009 ⁴⁴	Yes	Yes	Yes	No	No	Unclear	Yes	Yes	Yes	Unclear	Fair
Serpa, 2011 ³⁸	Yes	Yes	Yes	No	Yes	Unclear	Yes	Yes	Yes	Unclear	Fair
Stotts, 1988 ⁴¹	Yes	Yes	Unclear	No	No	Yes	Yes	Yes	Yes	No	Fair
Tourtual, 1997 ³⁹	Unclear	Yes	Unclear	No	No	Yes	Yes	Unclear	Yes	Unclear	Poor
Towey, 1988 ³¹	Yes	Unclear	Yes	No	Yes	Unclear	Yes	Yes	Yes	Unclear	Fair
van Marum, 2000 ¹⁵	Yes	Yes	Unclear	No	No	Yes	Unclear	Yes	Unclear	Unclear	Fair
VandenBosch, 1996 ⁵²	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Good
Wai-Han, 1997 ¹⁷	Yes	Yes	Yes	No	Yes	Unclear	Yes	Yes	Yes	Unclear	Fair
Webster, 2010 ⁴⁵	Yes	Yes	Unclear	No	Yes	Yes	Yes	No	No	Unclear	Fair

Author, year	Representative spectrum?	Evaluated a population other than the one used to derive the screening instrument?	Random or consecutive sample?	Study reported that groups received comparable interventions?	Test cutoffs predefined?	Credible reference standard?	Reference standard applied to all patients, or a random subset?	Low attrition?	Same reference standard applied to all patients?	Blinding: Reference standard interpreted independently from test under evaluation?	Quality Rating
Westrate, 1998 ⁴⁶	Unclear (some children included)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Fair

Appendix H6. Key Question 2: Sensitivity and Specificity of Pressure Ulcer Risk Assessment Scales

Study	Cutoff	Sensitivity	Specificity
Braden			
Baldwin, 1998 ¹⁸	≤10	0.91	0.96
Serpa, 2011 ³⁸	≤12	0.86	0.65
Tortual, 1997 ³⁹	≤12	0.14	0.94
Serpa, 2011 ³⁸	≤13	0.71	0.82
Kim, 2009 ⁸	≤14	0.93	0.7
Kwong, 2005 ⁹	≤14	0.89	0.72
Baldwin, 1998 ¹⁸	≤15	0.09	0.71
Bergstrom, 1987a ²⁰	≤15 (Study 1)	0.71	0.95
Bergstrom, 1987a ²⁰	≤15 (Study 2)	0.8	0.74
Bergstrom, 1987b ²¹	≤15	0.75	0.67
Bergstrom, 1998 ²³	≤15 (Tertiary care units)	0.46	0.9
Bergstrom, 1998 ²³	≤15 (VAMC units)	0.2	0.94
Bergstrom, 1998 ²³	≤15 (Skilled nursing facility)	0.33	0.93
Braden, 1994 ²⁵	≤15	0.32	0.95
Goodridge, 1998 ²⁹	≤15	0.09	0.91
Halfens, 2000 ³¹	≤15	0.22	0.95
Langemo, 1991 ³²	≤15	0.55	0.94
Lewicki, 2000 ³³	≤15	0.33	0.92
Olson, 1998 ³⁶	≤15 (Study 1)	0.82	0.88
Olson, 1998 ³⁶	≤15 (Study 2)	0.42	0.9
Ramundo, 1995 ³⁷	≤15	0.14	0.83
Salvadalena, 1992 ¹²	≤15	0.3	0.77
	Median: ≤15	0.33 (0.09 to 0.82)	0.91 (0.67 to 0.95)
Bergstrom, 1987a ²⁰	≤16 (Study 1)	1	0.9
Bergstrom, 1987a ²⁰	≤16 (Study 2)	1	0.64
Chan, 2005 ²⁷	≤16	0.67	0.64
Hagisawa, 1999 ³⁰	≤16	0.39	1
Seongsook, 2004 ¹⁴	≤16	0.97	0.26
Barnes, 1993 ¹⁹	≤16	0.73	0.91
Feuchtinger, 2007 ⁶	≤16	0.78	0.29
Lyder, 1998 ³⁴	≤16	0.35	1
Lyder, 1999 ³⁵	≤16 (blacks)	0.77	0.5
Lyder, 1999 ³⁵	≤16 (Hispanics)	0.9	0.14
Tortual, 1997 ³⁹	≤16	0.49	0.76
	Median: ≤16	0.77 (0.35 to 1)	0.64 (0.14 to 1)
	Excluding poor quality study	0.78 (0.35 to 1)	0.64 (0.14 to 1)
DeFloor, 2005 ⁵	<17	0.8	0.65

Study	Cutoff	Sensitivity	Specificity
VandenBosch, 1996 ¹⁶	≤17	0.59	0.41
DeFloor, 2005 ⁵	<18	0.83	0.58
Schoonhoven, 2002 ¹³	<18	0.44	0.68
Bergstrom, 1987a ²⁰	≤18 (Study 1)	1.0	0.83
Bergstrom, 1987a ²⁰	≤18 (Study 2)	1.0	0.51
Bergstrom, 1987b ²¹	≤18	0.92	0.39
Bergstrom, 1998 ²³	≤18 (Tertiary care units)	0.88	0.68
Bergstrom, 1998 ²³	≤18 (VAMC units)	0.6	0.81
Bergstrom, 1998 ²³	≤18 (Skilled nursing facility units)	0.72	0.68
Braden, 1994 ²⁵	≤18	0.79	0.74
Capobianco, 1996 ²⁶	≤18	0.71	0.83
Goodridge, 1998 ²⁹	≤18	0.47	0.68
Halfens, 2000 ³¹	≤18	0.51	0.86
Langemo, 1991 ³²	≤18	0.57	0.61
Lewicki, 2000 ³³	≤18	0.33	0.85
Lyder, 1999 ³⁵	≤18	0.81	1
Olson, 1998 ³⁶	≤18 (Study 1)	0.91	0.71
Olson, 1998 ³⁶	≤18 (Study 2)	0.72	0.71
Pang, 1998 ¹⁰	≤18	0.91	0.62
Ramundo, 1995 ³⁷	≤18	1	0.34
Salvadalena, 1992 ¹²	≤18	0.6	0.54
	Median: ≤18	0.74 (0.33 to 1)	0.68 (0.34 to 0.86)
	Excluding poor quality study	0.72 (0.33 to 1)	0.68 (0.39 to 0.86)
Feuchtinger, 2007 ⁵	≤20	0.97	0.05
Jalali, 2005 ⁷	Unclear	0.53	1
Extended/Modified Braden			
Halfens, 2000 ³¹	≤15 (extended Braden)	0.07	0.99
Halfens, 2000 ³¹	≤18 (extended Braden)	0.24	0.95
Kwong, 2005 ⁹	≤16 (modified Braden)	0.89	0.75
Norton			
Bale, 1995 ¹	≤10	1	0.31
DeFloor, 2005 ⁵	<12	0.62	0.72
DeFloor, 2005 ⁵	<14	0.82	0.59
Wai-Han, 1997 ¹⁷	≤14	0.75	0.68
Kwong, 2005 ⁹	≤14	0.89	0.61
Lincoln, 1986 ⁴⁰	≤14	0	0.85
Stotts, 1988 ^{*53}	≤14	0.16	0.95
	Median: ≤14	0.75 (0 to 0.89)	0.68 (0.59 to 0.95)
	Excluding Lincoln 1986	0.78 (0.16 to 0.89)	0.65 (0.59 to 0.95)
	Excluding Stott 1988	0.78 (0 to 0.89)	0.65 (0.59 to 0.85)

Study	Cutoff	Sensitivity	Specificity
	Excluding Lincoln 1986 and Stott 1988	0.82 (0.75 to 0.89)	0.61 (0.59 to 0.68)
Schoonhoven, 2002 ¹³	<16	0.46	0.6
Pang, 1998 ¹⁰	≤16	0.81	0.59
van Marum, 2000 ¹⁵	≤16	0.75	0.55
	Median ≤16	0.75 (0.46 to 0.81)	0.59 (0.55 to 0.6)
Jalali, 2005 ⁷	Unclear	0.49	1
Modified Norton			
Feuchtinger, 2007 ⁶	≤21	0.33	0.94
Feuchtinger, 2007 ⁶	≤23	0.41	0.88
Feuchtinger, 2007 ⁶	≤25	0.58	0.47
Waterlow			
Schoonhoven, 2002 ¹³	>9	0.46	0.6
Boyle, 2001 ⁴	≥10	1	0.13
Wai-Han, 1997 ¹⁷	≥10	0.88	0.29
Webster, 2010 ⁴⁵	≥15	0.67	0.79
Westrate, 1998 ⁴⁶	≥15	0.81	0.29
Pang, 1998 ¹⁰	≥16	0.95	0.44
Serpa, 2009 ⁴⁴	≥17	0.71	0.67
Serpa, 2009 ⁴⁴	≥20	0.86	0.33
Edwards, 1995 ⁴³	Unclear	1	0.1
Jalali, 2005 ⁷	Unclear	0.63	0.83
Jackson and Cubbin			
Seongsook, 2004 ¹⁴	≤24	0.89	0.61
Kim, 2009 ⁸	≤28	0.95	0.82
Boyle, 2001 ⁴	≤29	0.83	0.42
Clinical Judgment			
Defloor, 2005 ⁵	Risk vs. no risk	0.74	0.5
Salvadalena, 1992 ¹²	Risk vs. no risk	0.5	0.79
van den Bosch, 1996 ¹⁶	Risk vs. no risk	0.52	0.59
	Median: risk vs. no risk	0.52	0.59

*Used a slightly modified version of the Norton scale.

Appendix H7. Key Question 2: Sensitivity and Specificity of Pressure Ulcer Risk Assessment Scales: Setting

Study	Scale	Cutoff	Sensitivity	Specificity	Notes
Home care					
Ramundo, 1995 ³⁷	Braden	≤15	0.14	0.83	
		≤18	1	0.34	
Edwards, 1995 ⁴³	Waterlow	Unclear	1	0.1	
Hospice					
Bale, 1995 ¹	Modified Norton	≤10	1	0.31	Modified Norton: scoring reversed and additional risk factors included
Hospital, acute care					
Baldwin, 1998 ¹⁸	Braden	≤10	0.91	0.96	
Tortual, 1997 ³⁹	Braden	≤12	0.14	0.94	
Kwong, 2005 ⁹	Braden	≤14	0.89	0.72	
Baldwin, 1998 ¹⁸	Braden	≤15	0.09	0.71	
Bergstrom, 1987 ²¹	Braden	≤15	0.75	0.67	
Bergstrom, 1998 ²³	Braden	≤15	0.46	0.9	Time 2 assessment, tertiary care units
		≤15	0.2	0.94	Time 2 assessment, VAMC units
Goodridge, 1998 ²⁹	Braden	≤15	0.09	0.91	
Halfens, 2000 ³¹	Braden	≤15	0.22	0.95	
Olson, 1998 ³⁶	Braden	≤15	0.82	0.88	
		≤15	0.42	0.9	
Salvadalen a, 1992 ¹²	Braden	≤15	0.3	0.77	
	Median	≤15	0.26 (0.09 to 0.82)	0.9 (0.67 to 0.95)	
Barnes, 1993 ¹⁹	Braden	≤16	0.73	0.91	
Feuchtinger, 2007 ⁶	Braden	≤16	0.78	0.29	
Lyder, 1998 ³⁴	Braden	≤16	0.35	1	
Lyder, 1999 ³⁵	Braden	≤16	0.77	0.5	black patients
Lyder, 1999 ³⁵	Braden	≤16	0.9	0.14	Hispanic/Latino patients
Seongsook, 2004 ¹⁴	Braden	≤16	0.97	0.26	
Tortual, 1997 ³⁹	Braden	≤16	0.49	0.76	
	Median	≤16	0.77 (0.35 to 0.97)	0.5 (0.14 to 1)	
Chan, 2005 ²⁷	Braden	≤17	0.67	0.64	
Hagisawa, 1999 ³⁰	Braden	≤17	0.39	1	
VandenBosch, 2001 ⁵²	Braden	≤17	0.59	0.41	
	Median	≤17	0.59 (0.39 to 0.67)	0.64 (0.41 to 1)	
Bergstrom, 1987 ²¹	Braden	≤18	0.92	0.39	

Study	Scale	Cutoff	Sensitivity	Specificity	Notes
Bergstrom, 1998 ²³	Braden	≤18	0.88	0.68	Time 2 assessment, tertiary care units
		≤18	0.6	0.81	Time 2 assessment, VAMC units
Capobianco, 1996 ²⁶	Braden	≤18	0.71	0.83	
Goodridge, 1998 ²⁹	Braden	≤18	0.47	0.68	
Halfens, 2000 ³¹	Braden	≤18	0.51	0.86	
Lyder, 1999 ³⁵	Braden	≤18	0.81	1	
Olson, 1998 ³⁶	Braden	≤18	0.72	0.71	
	Braden	≤18	0.91	0.71	
Pang, 1998 ¹⁰	Braden	≤18	0.91	0.62	
Salvadalen a, 1992 ¹²	Braden	≤18	0.6	0.54	
	Median	≤18	0.72 (0.47 to 0.92)	0.71 (0.39 to 1)	
Feuchtinger, 2007 ⁶	Braden	≤20	0.97	0.05	
Jalali, 2005 ⁷	Braden	unclear	0.53	1	
Seongsook, 2004 ¹⁴	Cubbin and Jackson	≥24	0.89	0.61	
Boyle, 2001 ⁴	Cubbin and Jackson	≥29	0.83	0.42	
Kwong, 2005 ⁹	Norton	≤14	0.89	0.61	
Lincoln, 1986 ⁴⁰	Norton	≤14	0	0.85	
Schoonhoven, 2002 ¹³	Norton	<16	0.46	0.6	
Pang, 1998 ¹⁰	Norton	≤16	0.81	0.59	
Feuchtinger, 2007 ⁶	Modified Norton	≤21	0.33	0.94	Modified Norton: Includes skin condition, motivation and age
		≤23	0.41	0.88	Modified Norton: Includes skin condition, motivation and age
		≤25	0.58	0.47	Modified Norton: Includes skin condition, motivation and age
Jalali, 2005 ⁷	Norton	unclear	0.49	1	
Perneger, 2002 ¹¹	Norton	unclear	no data	no data	
Schoonhoven, 2002 ¹³	Waterlow	>9	0.46	0.6	
Boyle, 2001 ⁴	Waterlow	≥10	1	0.13	
Webster, 2010 ⁴⁵	Waterlow	≥15	0.67	0.79	
Westrate, 1998 ⁴⁶	Waterlow	≥15	0.81	0.29	
Pang, 1998 ¹⁰	Waterlow	≥16	0.95	0.44	
Serpa, 2009 ⁴⁴	Waterlow	≥17	0.71	0.67	
		≥20	0.86	0.33	
Jalali, 2005 ⁷	Waterlow	unclear	0.63	0.83	
ICU					
Serpa, 2011 ³⁸	Braden	≤12	0.86	0.65	1st assessment
		≤13	0.71	0.82	2nd assessment
		≤13	0.71	0.83	3rd assessment
Bergstrom, 1987b ²¹	Braden	≤15	0.75	0.67	
Seongsook,	Braden	≤16	0.97	0.26	

Study	Scale	Cutoff	Sensitivity	Specificity	Notes
2004 ¹⁴					
Bergstrom, 1987b ²¹	Braden	≤18	0.92	0.39	
Seongsook, 2004 ¹⁴	Cubbin and Jackson	≤24	0.89	0.61	
Boyle, 2001 ⁴	Cubbin and Jackson	≤29	0.83	0.42	
	Waterlow	≥10	1	0.13	
Long-term care					
Bergstrom, 1998 ²³	Braden	≤15	0.31	0.94	Time 2 assessment
Braden, 1994 ²⁵	Braden	≤15	0.32	0.95	
Defloor, 2005 ⁵	Braden	≤17	0.8	0.65	
Bergstrom, 1998 ²³	Braden	≤18	0.72	0.68	Time 2 assessment
Braden, 1994 ²⁵	Braden	≤18	0.79	0.74	
Defloor, 2005 ⁵	Braden	≤18	0.83	0.58	
Langemo, 1991 ³²	Braden	≤18	0.57	0.61	
	Median	≤18	0.76 (0.57 to 0.83)	0.65 (0.58 to 0.74)	
Defloor, 2005 ⁵	Norton	≤12	0.62	0.72	
		≤14	0.82	0.59	
Surgical					
Kim, 2009 ⁸	Braden	≤14	0.93	0.7	
Lewicki, 2000 ³³	Braden	≤15	0.33	0.92	
Feuchtinger, 2007 ⁶	Braden	≤16	0.78	0.29	
Lewicki, 2000 ³³	Braden	≤18	0.33	0.85	
Feuchtinger, 2007 ⁶	Braden	≤20	0.97	0.05	
Kim, 2009 ⁸	Cubbin and Jackson	≤28	0.95	0.82	
Stotts, 1988 ⁴¹	Modified Norton	≤14	0.16	0.95	Modified Norton: Includes clarification on rating category definitions
Feuchtinger, 2007 ⁶	Modified Norton	≤21	0.33	0.94	Modified Norton: Includes skin condition, motivation and age
		≤23	0.41	0.88	Modified Norton: Includes skin condition, motivation and age
		≤25	0.58	0.47	Modified Norton: Includes skin condition, motivation and age
Westrate, 1998 ⁴⁶	Waterlow	≥15	0.81	0.29	

Appendix H8. Key Question 2: Pressure Ulcer Risk Assessment Scales Area Under the Receiver Operating Characteristic Curve: Setting

Study	Scale	Setting	AUROC	Quality Rating	Notes
Hospital, acute care					
Chan, 2009 ²⁸	Braden	Hospital inpatient n=197	0.68	Fair	
Perneger, 2002 ¹¹	Braden	Hospital inpatient n=1,190	0.74	Fair	
Schoonhoven, 2002 ¹³	Braden	Hospital inpatient n=1,229	0.55	Good	
Perneger, 2002 ¹¹	Norton	Hospital inpatient n=1,190	0.74	Fair	
Schoonhoven, 2002 ¹³	Norton	Hospital inpatient n=1,229	0.56	Good	
Serpa, 2009 ⁴⁴	Waterlow	Hospital inpatient n=98	0.64	Fair	1st assessment
		Hospital inpatient n=98	0.54	Fair	2nd assessment
ICU					
Seongsook, 2004 ¹⁴	Braden	Hospital inpatient; ICU n=112	0.71	Good	
Serpa, 2011 ³⁸	Braden	Hospital inpatient; ICU n=92	0.79	Fair	1st assessment
		Hospital inpatient; ICU n=92	0.79	Fair	2nd assessment
		Hospital inpatient; ICU n=92	0.8	Fair	3rd assessment
Boyle, 2001 ⁴	Waterlow	Hospital inpatient; ICU n=534	0.66	Fair	
Compton, 2008 ⁴²	Waterlow	Hospital inpatient; ICU n=698	0.58	Fair	
Boyle, 2001 ⁴	Cubbin and Jackson	Hospital inpatient; ICU n=534	0.72	Fair	
Seongsook, 2004 ¹⁴	Cubbin and Jackson	Hospital inpatient; surgical, internal or neurological ICU n=112	0.83	Good	
Surgical					
Kim, 2009 ⁸	Braden	Post-surgery inpatient n=219	0.88	Fair	
	Cubbin and Jackson	Hospital inpatient; surgical ICU n=219	0.9	Fair	
Long-term care					
DeFloor, 2005 ³	Braden	Long-term care facilities n=1,772	0.77	Fair	
	Norton	Long-term care facilities n=1,772	0.75	Fair	

Appendix H9. Key Question 2: Optimal Pressure Ulcer Risk Assessment Scale Cutoffs

Study	Scale	Setting	Optimal Cutoff*	Notes
Langemo, 1991 ³²	Braden	Acute care	15	
Chan, 2009 ²⁸	Braden	Acute care	16	
Capobianco, 1996 ²⁶	Braden	Acute care	18	
Olson, 1998 ³⁶	Braden	Acute care	19	
Serpa, 2011 ³⁸	Braden	ICU	13	
Braden, 1994 ²⁵	Braden	Long term care	18	
Defloor, 2005 ⁵	Braden	Long term care	18	Noted poor predictive value; still performed better than clinical judgment alone
Langemo, 1991 ³²	Braden	Skilled care	18	
Bergstrom, 1992 ²²	Braden	Skilled care	16 or 17	
Kim, 2009 ⁸	Braden	Surgical	14	
Lewicki, 2000 ³³	Braden	Surgical	13, 14, 20	Optimal cutoff depended on timing of risk assessment
Kim, 2009 ⁸	Cubbin and Jackson	Surgical	28	
Chan, 2009 ²⁸	Modified Braden	Acute care	19	
Defloor, 2005 ⁵	Norton	Long term care	14	Noted poor predictive value; still performed better than clinical judgment alone
Serpa, 2009 ⁴⁴	Waterlow	Acute care	17	

*Optimal cutoffs were determined based on the best balance of sensitivity and specificity or by maximizing sensitivity.

Appendix H10. Key Question 2: Area Under the Receiver Operating Characteristic Curve by Baseline Risk Score

Study	Mean Baseline Score	Setting	AUROC	Quality Rating	Comments
Braden					
DeFloor, 2005 ⁵	17	Long-term care facilities n=1,772	0.77	Fair	
Schoonhoven, 2002 ¹³	20	Hospital inpatient n=1,229	0.55	Good	
Chan, 2009 ³⁸	Not reported	Hospital inpatient n=197	0.68	Fair	
Perneger, 2002 ¹¹	Not reported	Hospital inpatient n=1,190	0.74	Fair	
Kim, 2009 ⁸	Not reported	Hospital inpatient; ICU n=219	0.88	Fair	
Seongsook, 2004 ¹⁴	Not reported	Hospital inpatient; ICU n=112	0.71	Good	
Serpa, 2011 ³⁸	Not reported	Hospital inpatient; ICU n=92	0.79	Fair	1st assessment
		Hospital inpatient; ICU n=92	0.79	Fair	2nd assessment
		Hospital inpatient; ICU n=92	0.8	Fair	3rd assessment
Norton					
DeFloor, 2005 ⁵	14	Long-term care facilities n=1,772	0.75	Fair	
Schoonhoven, 2002 ¹³	17	Hospital inpatient n=1,229	0.56	Good	
Perneger, 2002 ¹¹	Not reported	Hospital inpatient n=1,190	0.74	Fair	
Waterlow					
Schoonhoven, 2002 ¹³	13	Hospital inpatient n=1,229	0.61	Good	
Boyle, 2001 ⁴	29	Hospital inpatient; ICU n=534	0.66	Fair	
Compton, 2008 ⁴²	Not reported	Hospital inpatient; ICU n=698	0.58	Fair	
Serpa, 2009 ⁴⁴	Not reported	Hospital inpatient n=98	0.64	Fair	1st assessment
		Hospital inpatient n=98	0.54	Fair	2nd assessment
Cubbin and Jackson					
Boyle, 2001 ⁴	33	Hospital inpatient; ICU n=534	0.72	Fair	
Kim, 2009 ⁸	Not reported	Hospital inpatient; surgical ICU n=219	0.9	Fair	
Seongsook, 2004 ¹⁴	Not reported	Hospital inpatient; surgical, internal or neurological ICU n=112	0.83	Good	

Appendix H11. Key Question 3: Data Extraction of Support Surfaces Trials

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Andersen, 1982 ⁵⁴	Acute care Denmark	Patients at risk of pressure ulcer development using a simple risk score system, without existing sores	10 days	3,571/600/482	118 (prior to randomization); ~35% became ineligible during the course of the study	None	A. Alternating-air pressure mattress (n=166) B. Water mattress (camping mattress filled with lukewarm water) (n=155) C. Ordinary hospital mattress (n=166)	A vs. B vs. C Mean age: NR (age reported by ranges within groups, majority >60 years) % Female: 63% vs. 56% vs. 53%
Aronovitch, 1999 ⁵⁵ Quasi-randomized trial (comparative, parallel study with weekly randomization)	Surgical units (cardiothoracic, ENT, urology, and vascular surgery) United States	Patients ≥18 years of age undergoing a scheduled surgery with general anesthesia for at least 4 hours (actual operative time of ≥3 hours). Excluded patients if they participated in a clinical trial within 30 days of baseline visit or if they had a pressure ulcer at baseline visit (n=4 patients excluded because they were discharged home before postop day 4). Patients removed from study if they requested discontinuation, experienced adverse event that precluded continued treatment, or if investigator felt it was not in the best interest of the patient to continue in the study	7 days or until discharge (median NR)	NR/234/217	None	None	A. Alternating pressure system intra and postoperatively (Micropulse). Micropulse is thin pad with over 2,500 small air cells in rows; 50% cells inflated at any time (n=112) B. Conventional management (gel pad in operating room and replacement mattress postoperatively) (n=105)	Mean age, years: 63.5+/-11.9 vs. 64.7+/-11.8 Age distribution: < 50 years 12.7% vs. 16.3% 50-60 years 21.8% vs. 17.3% 61-70 37.3% vs. 27.9% > 70 years 28.2% vs. 38.5% % female: 28.2% (31/110) vs. 26% (27/104) Race distribution: Caucasian 95.5% vs. 92% Black 3.6% vs. 7% Hispanic 0 vs. 1% Other 0.9% vs. 0 Mean weight, pounds: 178.7+/-40.35 vs. 168.1+/-39.79 Mean height, inches: 66.23+/-17.51 vs. 68.12+/-4.248 Smoking status: Smoker 23.8% (25/105) vs. 30.4% (21/102) Never smoked 20.0% (21/105) vs. 17.6% (18/102) Ex-smoker 56.2% (59/105) vs. 52.0% (53/102) Baseline skin risk assessment score for both groups <4 (range: 0-13) *All data not available for all patients (p=NS for all)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Berthe, 2007 ⁵⁶ Randomized trial	Hospital (medical and surgical wards) Belgium	Patients admitted for at least 24 hours, free of bed sores	Until PU incidence (median and length without PU unclear)	NR/1729/1729	0	0	A: Kliniplot foam block mattress (n=657) B: Standard hospital mattress (n=1072)	NR
Brienza, 2010 ⁵⁷	Nursing homes United States	Inclusion: nursing home resident, aged 65+, Braden score ≤ 18, combined Braden Activity and Mobility subscale ≤ 5, absence of ischial area PU, tolerance for daily wheel chair sitting 6+ hours, ability to accommodate seating and positioning needs with the wheelchairs selected for study use Exclusion: body weight > 113kg, hip width > 51 cm, various wheelchair seating requirements, current use of wheelchair cushions other than segmented foam cushions (SFCs) or their equivalent or lower-quality	6 months or until PU incidence, discharge, or death (median NR)	NR/232/232	A vs. B: Did not receive intervention: 5.3% (6/113) vs. 3.4% (4/119) Death: 11.5% (13/113) vs. 12.6% (15/119) Voluntary withdrawal: 4.4% (5/113) vs. 5.0 % (6/119)	A vs. B: 18.6% (21/113) vs. 17.6% (21/119)	A: Skin Protection Cushions (SPC), including Quadtro (Roho, Inc.), J2 Deep Contour (Sunrise Medical, Inc.), Infinity MC (Invacare Corporation) (n=113) B: Cross-cut 7.6cm thick, Segmented Foam Cushion (SFC) (Span-America Medical Systems, Inc., Greenville, SC) - standard care (n=119)	Mean age: 86.8 years (SD ± 7.4) vs. 86.6 years (SD ± 7.8) % women: 80.5% (91/113) vs. 89.1% (106/119) % nonwhite: 8.8% (10/113) vs. 6.7% (8/119)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Collier, 1996 ⁵⁸	Hospital United Kingdom	Patients with a low Waterlow score (low risk) were not excluded	Length of hospital stay (median NR)	NR/NR/90	9 due to one mattress manufacturer's decision to remove the mattress from the study	NR	Comparison of 8 foam mattresses: A. New Standard Hospital Mattress (Relyon) (130 mm) (n=9) B. Clinifloat (n=11) C. Omnifoam (n=11) D. Softform (n=12) E. STM5 (n=10) F. Therarest (n=13) G. Transfoam (n=10) H. Vapourlux (n=14)	% women: 60% (59/99)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Conine, 1993 ⁵⁹	Extended care facility, wheelchair cushions Canada	Patients ≥60 years, free of any skin breakdown for at least 2 weeks prior to study, considered to be at high risk of pressure sores (Norton score ≤14), sitting in wheelchair for minimum of 4 consecutive hours for normal daily activities, and free of progressive disease which could confine them to bed. Excluded patients if they had diabetes or peripheral vascular disease, if they became confined to bed during trial for >120 consecutive hours due to reasons other than pressure sores, or if their status of high risk improved.	3 months (median NR)	NR/288/248	A vs. B (p=NS for all) Discomfort: 1% (2/144) vs. 1% (2/144) Transferred: 3% (4/144) vs. 2% (3/144) Score change (Norton score>15): 2% (3/144) vs. 3% (4/144) Total dropouts: 13% (19/144) vs. 15% (21/144)* *includes 10 deaths in group A and 12 deaths in group B Note: Above patients were not included in analysis	See withdrawals	A. Contoured foam cushion individually customized by seating specialist, with a posterior cut out in the area of ischial tuberosities and an anterior ischial bar (n=123) B. Slab cushion made of medium-high density polyurethane foam, bevelled at base to prevent seat sling (n=125) Note: Both cushions were covered by the identical polyester covers with laminated waterproof inside. Patients assigned to wheelchairs by institutions' personnel. All patients given equal medical, nursing, nutritional and rehabilitation care.	Mean age: 84 vs. 83.5 years % female: 79.6 (98/123) vs. 77.6% (97/125) (p>0.05 for all)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Conine, 1994 ⁶⁰ Modified sequential randomized trial	Extended care facility, wheelchair cushions Canada	Patients aged ≥ 60 years, assessed at high risk of pressure sores (Norton score ≥ 14), free of pressure ulcer for at least 2 weeks prior to the study, sitting in a wheelchair daily for minimum of four consecutive hours, free of any progressive disease which could confine them to bed. Excluded patients if they had diabetes, or peripheral vascular disease, became confined to bed for more than 120 consecutive hours due to reasons other than pressure ulcer, or had change in high risk status during the study	3 months (median NR)	NR/163/141	A vs. B Discomfort: 1% (1/83) vs. 7% (6/80), $p=0.05$ Transferred: 2% (2/83) vs. 1% (1/80) Score change (Norton score >15): 4% (3/83) vs. 3% (2/80) Total dropouts: 12% (10/83) vs. 15% (12/80)* *includes 4 deaths in group A and 3 deaths in group B Note: Above patients were not included in analysis	See withdrawal s	A. Jay cushion; the Jay cushion is a contoured urethane foam base with gel pad over top (n=68) B. Foam cushion; 32 kg/m ³ density foam bevelled at the bottom to prevent sling effect (n=73)	Mean age 82 years % female: 85%

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Conine, 1990 ⁶¹ Modified sequential randomized trial	Extended care facility Canada	Patients aged 18 to 55 years, with no evidence of skin breakdown for at least 2 weeks prior to the study, who were at high risk of developing pressure ulcers according to the Norton's scale (score \leq 14). Excluded patients if their high risk status changed during the study.	3 months (median NR)	NR/187/148	A vs. B (p=NS for all) Discomfort: 20% (19/93) vs. 18% (17/94) Transferred: 0 vs. 1% (1/94) Total dropouts: 22% (21/93) vs. 19% (18/94)* *includes 2 deaths in group A Note: Above patients were not included in analysis	See withdrawal s	A. Alternating- pressure overlay, 10-cm air cells that alternately inflate and deflate by electronic pump (cycle time not reported, nor the make of overlay) (n=72) B. Silicore (Spenco) overlay; siliconized hollow fibers in waterproofed cotton placed over standard hospital mattress (spring or foam) (n=76) Note: Both groups received usual care (2-3 hourly turning; daily bed baths; weekly bath/shower; use of heel, ankle and other protectors)	Mean age, years (SD; range): 38.8 (13.0;19-55) vs. 35.6 (13.0;21-55) % female: 56.9%(41/72) vs. 61.8% (47/76) (p=NS for all)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Follow up	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Cooper, 1998 ⁶²	Acute care United Kingdom	Patients > 65 years, no existing pressure ulcers, and a Waterlow score ≥ 15	7 days	NR/100/100	16	0	A: Sofflex immersion air mattress, 2 separate air sections and a foam section for the head, larger cells (n=51) B: Roho immersion air mattress, 3 separate air sections and a foam section for the head, smaller cells (n=49) Note: Both mattress systems are constructed with flexible interconnecting air cells manufactured from neoprene and have protective covers	Mean age: 83 vs. 83 years % female: 86% (44/51) vs. 82% (40/49) Orthopedic patients
Daechsel, 1985 ⁶³	Long-term care Canada	Patients between 19 and 60 years old, free of skin deterioration two weeks prior to study, and considered to be high risk according to Norton Scale and independent clinical judgment	3 months	NR/32/32	0	0	A. Alternating- pressure mattress (n=16) B. Silicone-filled mattress (n=16)	Mean age: 42.6 vs. 38.5 years Sex: 37.5% (6/16) vs. 62.5% (10/16) All chronic neurologic patients
Donnelly, 2011 ⁶⁴	Hospital (fracture trauma unit) United Kingdom	Patients aged ≥ 65 with a hip fracture in the prior 48 hours Exclude: Existing heel pressure damage and/or a history of pressure ulcers	10.8 days (control) vs. 12.2 days (intervention)	705/239/239	12 (3 in control group and 9 in intervention group)	2 (1 in each group)	A. Heelift Suspension Boot (n=120) B. Usual care (n=119)	Mean age: 80.9 vs. 80.8 years Sex: 79.2% vs. 74.8% female Race: NR Fracture patients

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Feuchtinger, 2006 ⁶⁵	Surgical unit Germany	Patients scheduled for cardiac surgery with extracorporeal circulation, aged ≥ 18 years, not included in another study, and written informed consent obtained.	5 days	NR/175/175	None	None	A. Standard configuration; Operating room (OR) table with water filled warming mattress (n=90) B. Test configuration; OR table with water filled warming mattress and a 4- cm thermo active viscoelastic foam overlay (n=85) Note: Both tables also covered with moisture keeping disposable sheet and cotton sheet	Mean age, years (SD; range): 67.6 (10.8;33-92) vs. 68 (11;34-92) Number female: 23/90 vs. 27/85 BMI, mean (SD; range): 26.6 (4.2;18.6-40.1) vs. 27.2 (4.7;19.1- 48.2) (p>0.05 for all) Cardiac surgery patients

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Gebhardt, 1996 ⁶⁶ Cluster trial	Intensive care unit United Kingdom	Patients with Norton score <13 who had been in the unit for <3 days and had no sores. Excluded patients if condition improved so that Norton score >12 and no sore was present, if they were discharged or transferred to another ward or hospital, or if they died	Mean followup: 11 vs. 12 days	NR/52/43	A vs. B Transferred or died before 2nd assessment: n=2 vs. n=3 Note: Above 5 patients plus 4 used to trial equipment were not included in analysis Note: n=6 deaths per group during trial	None	A. Alternating- pressure air mattress (shallow small cell overlays, medium depth large cell overlays, deep mattresses and deep pulsating low-air-loss beds) (n=23) B. Various support surfaces including static support surfaces (foam mattresses/overla ys, fiber-, static air-, gel-, water-, and bead- overlays, and low- air-loss mattresses or beds) and dynamic support surfaces (air- fluidized bead beds) (n=20)	Mean age (range), years: 55 (23-83) vs. 60 (21-83) % female: 47.8% (11/23) vs. 35% (7/20)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Geyer, 2001 ⁶⁷ Pilot randomized trial	Nursing homes United States	Residents ≥ 65 years with Braden score ≤ 18 , combined Braden Activity and Mobility subscale score of ≤ 5 , an absence of sitting- surface pressure ulcers, tolerance for total daily wheelchair sitting time ≥ 6 hours and sitting needs that could be accommodated by the ETAC Twin wheelchair (including body weight <250 lbs)	Mean days to endpoint 99.9 vs. 76.3 days	NR/32/32	A vs. B Transferred or discharged: n=2 vs. n=3 Note: one subject per group died during study Note: all participants included in ITT analysis	See withdrawal s	A. Pressure- reducing wheelchair cushion and fitted incontinence cover. No single make of cushion specified, rather this could be selected by the nurse from a group of cushions based on the participants' clinical status (n=15) B. Generic 3-inch convoluted foam (eggcrate) cushion (Bioclinic Standard, Sunrise Medical), fitted incontinence cover, and solid seat insert (n=17)	Mean age: 85.2 vs. 84.1 years % female: 93.3% (14/15) vs. 94% (16/17) p=NS for all

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Gilcreast, 2005 ⁸⁸	Military tertiary-care academic medical centers United States	Patients with Braden score ≤ 14 , and able to read and write English (or surrogate able). Excluded patients with hip surgery, patients anticipated to be admitted for < 72 h, patients (or surrogates) unable to provide informed consent, and patients with preexisting pressure ulcer on foot or foot deformity. Hospital discharge, changes in enrollment criteria (i.e. Braden score >14) resulted in ending subjects participation in study. Occurrence of pressure ulcer also ended enrollment.	Mean time in study 7.5 days (SD 7.4)	5475/338/240	15% (36/240) said they no longer wanted to participate after 48 hours in the study	35% (84/240) ended study because they were discharged, 24% (57/240) no longer met study criteria, 15% (36/240) said they no longer wanted to participate after 48 hours in the study, 13% (32/240) died and 5.0% (12/240) developed pressure ulcers	A. Bunny Boot (fleece) high cushion heel protector (n=77) B. Egg crate heel lift positioner (holds the foot suspended above the bed surface with heel through a window) (n=87) C. Foot waffle air cushion (felt coated plastic inflatable plastic pillow that encircles the foot) (n=76) Note: Nurses added pillows to the bunny boot group	Mean age (SD; range), years: 63.9 (19.94;18-97) % female: 42% (101/240), p=.008; Race: 68% (163/240) White, 15.4% (37/240) Black, 16.3% Hispanic (39/240), 1% (1/240) Asian

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Goldstone, 1982 ⁶⁹	Hospital United Kingdom	Patients aged >60 y who arrived in the accident and emergency department with a suspected femur fracture	Unclear	NR/NR/75 Patients who did not suffer a fracture, or who requested to be removed from the intervention mattress, or who died before reaching the post operative ward were excluded from the analysis	NR	NR	A. Beaufort bead bed system overlay, renamed as "Neumark- Macclesfield Support System" (includes polystyrene bead- filled mattress on A&E trolley; bead- filled operating table overlay; bead-filled sacral cushion for operating table; bead-filled boots to protect heels on operating table (n=32) B. Standard supports in A&E, operating room, ward (n=43)	Age: >60 y % women: 90.6% and 83.7% Fracture patients
Gray, 1994 ⁷⁰	Hospital United Kingdom	Patients were recruited from the following specialties: orthopaedic trauma, vascular and medical oncology. To be included, patients had to be assessed using the Waterlow Score and have a score ≥ 15 (high risk) and were required to have intact skin on admission	10 days	NR/NR/170	NR	NR	A. Soffform mattress (n=90) B. Standard 130 mm NHS foam mattress (n=80)	Mean age: 76 vs. 74 years % women: 63.3% vs. 58.8% p=ns for all

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Gray, 2000 ⁷¹	Surgical, orthopedic, and medical wards United Kingdom	Emergency or list admission for bed rest or surgery, less than 353 lbs, skin intact, no existing skin conditions, no terminal illness	10 days	NR/100/98	0	2 (post- randomiza tion exclusions due to torn mattresse s)	A. Transfoamwave pressure-reducing mattress - trial (n=50)B: Transfoamwave pressure-reducing mattress - trial (n=50) B. Transfoam pressure-reducing mattress (n=50)	Mean age: 69 vs. 61 years % women: 40% vs. 38%
Gunningberg, 2000 ⁷²	Hospital, surgery Sweden	Patients aged over 65 years with a suspected hip fracture on arrival in assessment and emergency (A&E)	Until discharge, or 14 days postoperative	119/101/101	None	None	A: Visco-elastic foam mattress (A&E 10cm; Ward 7cm) (n=48) B: Standard mattress (A&E 5cm; Ward 10cm) (n=53) Note: While all patients received standard prevention protocols, those with grade I pressure ulcers in the usual care group received more preventive interventions than those in the intervention group (confound); results not reported for other pressure ulcer grades so unknown	Mean age: 84 years vs. 85 years % women: 79% vs. 81% p=NS for all Fracture patients

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Hofman, 1994 ⁷³ Randomized trial, stopped early	Surgery Netherlands	Patients with femoral neck fracture and concomitant high risk (score ≥ 8 per 1985 Dutch consensus meeting criteria) for the development of pressure sores. Patients with existing pressure sores of \geq grade 2 were excluded.	Post-operative period of 14 days	46/44/42 at week 1; 36 at week 2 2 excluded due to inadequate randomization	3 deceased; 5 discharged	None	A. Cubed foam mattress (Comfortex DeCube mattress) - allows removal of small cubes of foam from beneath bony prominences (n=21) B. Standard hospital mattress, polypropylene SG40 hospital foam mattress (n=23) Note: Both groups were treated according to the Dutch consensus protocol for the prevention of pressure ulcers	Age: 85.0 years vs. 83.9 years % women: 76.2% (16/21) vs. 95.7% (22/23) p=ns for all Fracture patients

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Hoshowsky, 1994 ⁷⁴ Quasi- experimental study	Surgery United States	Patients from weekday operative schedule of a large university teaching hospital. Placement in the supine or prone positions while undergoing surgery, older than 12 years of age, and possession of symmetrical lower limbs	Post-operative	NR/NR/505 people (1,010 legs)	None	None	Six combinations of the below mattresses using patients right and left heels or knees as controls; each person served as their own control: - Standard vinyl covered 2-inch thick foam OR table mattress (SFM) - Nylon fabric covered 2-inch thick foam and gel OR table mattress (FGM - Akros®, American Sterilizer Co.) - Viscoelastic dry polymer mattress overlay (VEO- Action®, Action Products Inc.) A. SFM vs. FGM (n=91) B. VEO above SFM vs. FGM (n=92) C. SFM vs. VEO above FGM (n=62) D. VEO above SFM vs. VEO above FGM (n=113) E. SFM vs. VEO above SFM (n=73) F. FGM vs. VEO above FGM (n=74)	Mean age: 47 years (17.1 SD) % women: 63.6% (321/505) Preexisting vascular disease: 6.3% (32/505) Preexisting hypertension: 20.4% (103/505) Preexisting diabetes mellitus: 7.5% (35/505) Current smokers: 23.8% (120/505) Past smokers: 2.4% (12/505)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Inman, 1993 ⁷⁵	Intensive care Canada	Critically ill patients admitted to the Critical Care Trauma Centre of Victoria Hospital, London, Ontario from March 1989 to November 1990. Eligible patients were >17 years of age, had an admission Acute Physiology and Chronic Health Evaluation II (APACHE II) score >15, and had an expected stay in the ICU of at least 3 days. Excluded patients with myocardial infarction, vascular and cardiac surgery, and drug overdoses	18.8±18.1 days vs. 15.4±13.9 days	NR/NR/100	None	None	A. Air suspension bed, (KinAir, Kinetic Concepts, Inc, San Antonio, Texas); smooth, low-friction, low shear surface with a high moisture vapor transmission rate; each section of the bed has separate air-controlled settings (n=49) B. Standard ICU bed (undefined), plus repositioning every 2 hours (n=49)	Age: 63.4±14.4 years vs. 65.4±13.9 years % women: 40.8% (20/49) vs. 55.1% (27/49)
Jesurum, 1996 ⁷⁶ Quasi- experimental pilot study	Hospital United States	Adult cardiovascular surgery patients with intra-aortic balloon pump	Post-operative period	NR/NR/39	0	5 eligible patients missed due to protocol breach	A. Low-air-loss mattress, 16 compartmentalized, separately controlled air sacs with a nylon quilted fabric cover (n=16) B. Standard foam mattress (n=20)	Mean age: 67 vs. 69 years % Female: 44% vs. 15% Race: 81% vs. 80% White 13% vs. 15% Hispanic 6% vs. 0 Black 0 vs. 5% East Indian Cardiovascular surgical patients

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Jolley, 2004 ⁷⁷ Open label randomized trial	Hospital Australia	Patients admitted to hospital during study period at low to moderate risk of developing a pressure ulcer on Braden scale. Excluded patients if they were assessed at "no risk" (requiring no intervention) or "high risk" (requiring more complex intervention), had any pre-existing ulcer, were <18 years old, had expected length of stay <48 hours, had darkly pigmented skin, making Stage 1 ulcer difficult to detect	7-7.9 days average	~1900/539/441	A vs. B 14/270 vs. 8/269 requested withdrawal after receiving intervention; 0 vs. 2 withdrew before receiving intervention Note: 10 patients in group A complained about discomfort and requested removal of sheepskin The following were followed up and included in analysis: 178/218 vs. 194/223 discharged; 2/218 vs. 5/223 died; 7/218 vs. 1/223 became high risk; 6/218 vs. 5/223 ward staff intervention; 11/218 vs. 10/223 other reason (e.g. Incontinence)	A vs. B 52/270 vs. 46/269 were randomized but did not receive intervention Note: Above were not included in analysis	A. Sheepskin mattress overlay: leather-backed with a dense, uniform 25 mm wool pile. Used as a partial mattress overlay. Pressure points that were not covered by sheepskin were protected by a second sheepskin, or specific sheepskin elbow and heel protectors. Overlays were changed 3 times a week (unless required). Received usual care including repositioning (n=218) B. Usual care as determined by ward staff. Included repositioning and any other PRD or prevention strategy with/without low-tech constant pressure relieving devices (n=223)	Mean age (range), years: 63.2 (18-97) vs. 61.1 (18-99) % female: 49% vs. 52% Note: Groups differed substantially by admission type with more emergency admissions in group A, but did not differ on other baseline demographic and clinical characteristics

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Kemp, 1993 ⁷⁸	Hospital and long-term care United States	Patients without pressure ulcers, at least 65 years old, with Braden score ≤ 16 (increased likelihood of developing pressure ulcer)	1 month	994/84/84	None	None	A. Convuluted foam overlay, 3 or 4 inches thick, depending on acute care or long-term care setting (n=45) B. Solid foam overlay, 4 inches thick, sculptured (n=39) Note: Standard nursing practice was to reposition patient every 2 hours if at risk of pressure ulcers and to apply moisture repelling ointments to protect skin of incontinent patients. Hospital setting used disposable under pads for incontinent patients while long term facility used reusable cloth under pads	Mean age (SD), years: 79.31 (7.54) vs. 82.64 (8.60) % women: 68.8% (31/45) vs. 93.1% (27/29) Race: 23/45 vs. 22/39 black, 21/45 vs. 17/39 white, 1/45 vs. 0/39 Hispanic p=NS for all

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Lim, 1988 ⁷⁹	Extended care facility Canada	Residents ≥ 60 years, free of any pressure ulcer for at least 2 weeks prior to the study, considered to be at high risk for developing ulcers (Norton Scale ≤ 14), using a wheelchair for ≥ 3 hours daily. Excluded residents if they had a progressive disease that could confine them to bed or if they became confined to bed for >120 consecutive hours due to reasons other than pressure ulcer	5 months	NR/62/52	n=1 in group A refused to continue Note: patient was not included in analysis	n=1 in group B transferred Note: 8 deaths during trial (2 in group A, 6 in group B) Note: Above were not included in analysis	A. Contoured foam cushion, cut into a customized shape to relieve pressure on ischial tuberosities (n=26) B. Foam slab cushion, 2.5 cm medium density foam glued to 5 cm firm chipped foam (n=26) Note: Both groups also received usual care	Mean age (SD; range), years: 83.0 (7.7;65-103) vs. 84.6 (8.2;70-104) % female: 76.9% (20/26) vs. 69.2% (18/26) p=NS for all

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
McGowan, 2000 ⁸⁰	Hospital (orthopedic wards) Australia	Patients aged ≥60 years, admitted with an orthopedic diagnosis, assessed at low or moderate risk of developing a pressure ulcer on the Braden scale, patient or significant other able to give informed consent. Excluded patients if patients assessed as no risk (requiring no intervention) or high risk (requiring more complex intervention) for developing pressure ulcers, patients with pre- existing pressure ulcer, non-English speaking patients (unless interpreter present), patients with anticipated stay <48 hours, colored skin patients where stage 1 ulcer detection is difficult	Post-operative period until discharge	NR/297/290 (unclear)	n=2 (one from each group) withdrew prior to data collection; n=6 in group A withdrew before completion of data collection due to discomfort; n=7 in group B vs. n=3 in group A withdrawn due to protocol violations Note: above included in ITT analysis	See withdrawal s	A. Australian Medical Sheepskin overlay; sheepskin heel and elbow protectors as required on top of standard hospital mattress and sheet. Sheepskins were changed as required (at least every 3 days) (n=155) B. Standard hospital mattress and sheet with or without other low tech constant pressure devices as required (n=142)	Mean age: 73.6 vs. 74 years % female: 54% (83/155) vs. 61% (87/142) Note: More patients in Group A were male and more were admitted for total knee replacement compared to Group B Orthopedic patients
Mistiaen, 2010 ⁸¹	Long-term care facility Netherlands	Newly admitted to one of eight nursing homes for primarily physical impairments, age ≥ 18 years, expected stay > 1 week, free of PU on sacrum Exclusion: darkly pigmented skin, allergy to wool, admitted for a primarily psycho- geriatric reason	30 days	1066/588/543	NR	A vs. B: 8.1% (24/295) vs. 7.2% (21/293)	A. Australian Medical Sheepskin on top of the mattress in the area of the buttocks (n=271) B. Control (n=272) Note: Both groups received usual care (includes all other pressure- reducing interventions; varied per group)	Mean age: 78 (26-97) years vs. 78 (27-98) years % women: 71% vs. 67% (p=ns for all) Somatic nursing home patients 40.5% cardiovascular disease 38% fracture patients

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Nixon, 1998 ⁸²	Hospital United Kingdom	Patients scheduled for elective major general, gynecological, or vascular surgery, ≥ 55 years old and position to be supine or lithotomy. Excluded patients with pressure damage of \geq Grade 2a pre-operatively, ward staff provision of pre-operative alternating pressure mattress, dark skin pigmentation which precludes reliable identification of Grade 1 and Grade 2a skin assessments, and skin conditions over the sacrum, buttocks, or heels which preclude reliable identification of Grade 1 and Grade 2a skin assessments	8 days	720/446/416	30	30	A. Dry visco-elastic polymer pad (torso area and heels) on standard operating table mattress (n=222) B. Standard operating table mattress plus heel support (Gamgee pad) (n=224) Note: Both groups received usual care (warming mattress)	Aged 55-69: 56% (124/222) vs. 57% (128/224) Aged ≥ 70 : 44% (98/222) vs. 43% (96/224) % women: 45% (101/222) vs. 48% (107/224) <90 min operation: 23% (50/222) vs. 18% (40/224) 90-179 min operation: 49% (108/222) vs. 49% (110/224) ≥ 180 min operation: 28% (62/222) vs. 33% (73/224) p=NR
Russell, 2000 ⁸³	Hospital and Surgery Canada	Patients ≥ 18 years, undergoing cardiothoracic surgery under general anesthesia, surgery of ≥ 4 hours duration, and free of pressure ulcers	7 days	NR/198/198	2	None	A. MicroPulse system in the OR and postoperatively (n=98) B. Conventional care (gel pad in OR, standard mattress postoperatively) (n=100)	Mean age: 65.2 (10.9 SD) vs. 65.2 (10.6 SD) % women: 23.5% (23/98) vs. 25% (25/100) Smoker: Never 37.1% (36/98) vs. 33.3% (33/100), Past 45.4% (44/98) vs. 51.5% (51/100), Current 17.5% (17/98) vs. 15.2% (15/100) Race: Caucasian 94.9% (93/98) vs. 87.0% (87/100), African-American 0 vs. 1.0% (1/100), Asian 2.0% (2/98) vs. 2.0% (2/100), Hispanic 0 vs. 3.0% (3/100), Other 3.1% (3/98) vs. 7.0% (7/100) Mean hours in surgery: 4.1 (1.0 SD) vs. 4.2 (1.1 SD) p=NR for all Cardiovascular surgery patients

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Sanada, 2003 ⁸⁴	Hospital Japan	Braden score \leq 16, bed bound, free of pressure ulcers at study admission, and required head elevation	Unclear	123/108/82	41	NR	<p>A. Double-layer air cell overlay (Tri cell): two layers consisting of 24 narrow cylinder air cells, cell pressure alternated at 5 minute intervals (n=37)</p> <p>B. Single-layer air cell overlay (Air doctor): single layer consisting of 20 round air cells, cell pressures alternated at 5 minute intervals (n=36)</p> <p>C. Standard hospital mattress (Paracare) (n=35)</p> <p>Notes: All groups had change of body position every 2 h, and special skin care to guard against friction and shear. Nutritional intervention was given where required</p>	<p>Mean age: 69.5 (14.7 SD) vs. 73.9 (10.4 SD) vs. 70.6 (10.7 SD), p=NS</p> <p>% women: 51.7 (15/29) vs. 42.3 (11/26) vs. 51.9 (14/27), p=NS</p> <p>All patients required head elevation, including stroke patients, recovering from surgery, and terminally ill</p>

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Schultz, 1999 ⁸⁵	Operating room United States	Patients scheduled for inpatient care, ≥ 18 years old, with surgery scheduled to last longer than 2 hours in the lithotomy or supine position. Excluded patients with an existing pressure ulcer, patients with severe chronic skin problems, or patients receiving only local anesthesia.	6 days	NR/NR/413	None	None	A. Experimental mattress overlay in operating room made of foam with a 25% indentation load deflection (ILD) of 30 lb and density of 1.3 cubic feet (n=206) B. Standard perioperative care (padding as required, including gel pads, foam mattresses, ring cushions [donuts] etc.) (n=207)	Mean age: 65.68 (11.66 SD) vs. 65.73 (12.87 SD) % women: 35.4% (73/206) vs. 35.7% (74/207) BMI: 27.06 (4.97 SD) vs. 27.03 (4.51 SD) Smoker: Never 26.2% (54/206) vs. 24.6% (51/207), Past 49.5% (102/206) vs. 52.2% (108/207), Current 23.3% (48/206) vs. 22.2% (46/207) Diabetes: 21.8% (45/206) vs. 24.1% (50/207) (p=NS for all) <u>Without pressure ulcers vs. with pressure ulcers:</u> No significant difference for patient type (same day admit vs. inpatient), gender, smoking status, preoperative albumin levels, OR time, or time to first position change.
Sideranko, 1992 ⁸⁶	Surgical intensive care unit United States	Patients with surgical ICU stay ≥ 48 h, presence of ventilatory support or some form of hemodynamic support on admission to surgical ICU. Exclude any evidence of existing skin breakdown upon admission to the surgical ICU.	Mean followup: 9.4 days	NR/NR/57	NR	NR	A. Alternating air mattress: 1.5-inch thick Lapidus Airfloat System (n=20) B. Static air mattress: 4-inch thick Gay Mar Sof Care (n=20) C. Water mattress: 4-inch thick Lotus PXM 3666 (n=17)	Mean age: 67.9 (11.1 SD) vs. 63.6 (16.6 SD) vs. 66.1 (15.6 SD) Mean days of surgical ICS stay: 10.0 (10.9 SD) vs. 9.4 (8.8 SD) vs. 8.9 (7.1 SD) Mean days on mattress: 20.3 (21.4 SD) vs. 19.8 (14.7 SD) vs. 20.5 (17.5 SD) % women (reported for whole group): 42.1% (24/57) (p=NS for all)

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Stapleton, 1986 ⁸⁷	Hospital United Kingdom	Female patients aged ≥65 years with fractured femur, without existing pressure ulcers, with a Norton score of ≤14	Unclear	NR/100/98	2	2	A. Large Cell Ripple (canvas or plastic) pads ("Talley") (n=32) B. Polyether foam pad 2 feet x 2 feet x 3-inch thickness (n=34) C. Spenco pad (n=34) Note: these materials were all already in use, but not systematically	Mean age: 81 years Aged >80: 62.5% (20/32) vs. 55.9% (19/34) vs. 64.7% (22/34) % women: 100%
Takala, 1996 ⁸⁸	Hospital Intensive care unit Finland	Admitted to hospital with expected stay in ICU exceeding five days Exclude: patients with accidental injuries	14 days	1,489/40/24	0	16 (10 patients excluded due to early discharge or death, 6 patients excluded due to unavailabl e interventio n mattress)	A. Carital Optima: constant, static low pressure mattress comprising 21 double air bags (one inside the other), which can be adjusted for the head, middle, and feet areas (n=21) B. Standard hospital foam mattress: 10 cm thick foam density 35 kg/m ³ (n=19)	Mean age: 60 years vs. 63 years % female: 43% vs. 32% Acute respiratory organ failure patients

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Taylor, 1999 ⁸⁹	Hospital United Kingdom	Inpatients aged ≥ 16 years, with intact skin, requiring a pressure-relieving support, and expected hospital stay of ≥ 7 days	Mean days: 10.5 vs. 11.6 days	NR/44/44	None	None	A. Alternating air pressure mattress (Pegasus Trinova), 19 cells that inflate and deflate in a 3-cell cycle over a 7.5 minute period; along with alternating air pressure redistributing chair cushion, 4 cells inflating and deflating over a 7.5 minute cycle (n=22) B. Alternating air pressure system (unnamed), cells inflating and deflating over a 10 minute cycle - control (n=22)	Mean age: 66.50 (2.20 SD) vs. 70.27 (2.73 SD), p=ns % women: 45.5% (10/22) vs. 40.9% (9/22), p=ns
Theaker, 2005 ⁹⁰	Hospital, Intensive care United Kingdom	Patients in ICU aged ≥ 18 years, deemed at high risk of pressure ulcer development (based on 5 factors, no details provided). Excluded those with pressure sores on admission and those transferred from hospitals or other ward areas and had been nursed on a pressure-relieving device other than the control mattress	14 days	68/62/62	None	None	A. KCI TheraPulse pulsating air suspension mattress (n=30) B. Hill-Rom Duo, constant low pressure or alternating-air options, intensive care unit standard mattress (n=32)	Mean age: 53 (range: 38-75) vs. 57 (range: 35-77) vs. 59 (range: 26-80) vs. 66 (range: 30-85) % women: 33% (10/30) vs. 41% (13/32)

Author, year Notes about study design, publication status	Setting Country	Eligibility Criteria and Exclusions	Patient Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Follow up	Intervention (Ns)	Baseline Demographics (Age, Percent Women, Race, etc.), p value
Tymec, 1997 ⁹¹	Hospital United States	Patients of select nursing units, with a Braden score \leq 16 and intact skin on the heels	Unclear	NR/NR/52	NR	NR	A. Foot Waffle ([EHOB Inc.] FDA approved, non- abrasive vinyl boot with built-in foot cradle and inflated air chamber). B. Hospital pillow under both legs from below knee to the Achilles tendon (n=52 total)	Mean age: 66.6 (16.5 SD) years % women: 44% (23/52) Race: 61% (32/52) African American, 37% (19/52) Caucasian, 2% (1/52) Asian
van Leen, 2011 ⁹²	Long-term care nursing facility Netherlands	Patients aged > 65 years, living in the nursing home with a Norton score < 13 Exclude: Pressure ulcer in the previous 6 months	6 months	NR/83/83	9 (died, 5 in cold foam group and 4 in the static air group, for reasons not related to the study [none developed ulcers])	None	A. Static air overlay on top of cold foam mattress (n=41) B. Standard cold foam mattress - control (n=42) Note: Repositioning was only begun when signs of developing a pressure ulcer of >grade 2 occurred	Mean age: 81.1 vs. 83.1 years % women: 78.6% vs. 82.9% p=ns for all Dementia: 73.8% vs. 75.6%

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Vyhldal, 1997 ⁹³	Skilled nursing facility United States	Patients newly admitted to the skilled nursing facility with an estimated stay of at least 10 days, free of existing pressure ulcers, at-risk for pressure ulcer development (Braden score <18 with a subscale score of <3 in sensory perception, mobility, or activity levels)	10-21 days	492/40/40	None	None	A. MAXIFLOAT (BG Industries, Northridge, CA), a foam replaceable parts mattress with 4 primary parts: a water repellent antibacterial cover, a 1.5-inch thick 2.4 lb antimicrobial foam dual indentation force load deflection, a foam center core with heel pillow, and waterproof antibacterial bottom cover (n=20) B. IRIS 3000 (Bio Clinic of Sunrise Medical Group, Ontario, CA), a 4- inch thick 1.8 lb foam overlay with a dimpled surface (n=20) Note: Subjects in both groups received standards of care according to the protocols of the organization	Mean age: 74.3 vs. 80.2 years, p=0.19 % women: 55% (11/20) vs. 55% (11/20), p=1.0 Most common admitting diagnoses: musculoskeletal 45%, cardiovascular disease 27.5%

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Andersen, 1982 ⁵⁴	Scores ranged from 2 to 7 (total scale range 0-11), p=ns Study's own risk assessment tool, score of >2 indicates at risk	At risk	No	<u>Incidence (number pressure ulcers):</u> 4.2% (7/166) vs. 4.5% (7/155) vs. 13.0% (21/161), p<0.01 A vs. C: RR = 0.32, 95% CI 0.14-0.74 B vs. C: RR = 0.35, 95% CI 0.15-0.79	NR	NR	NR	Poor	NR
Aronovitch, 1999 ⁵⁵ Quasi-randomized trial (comparative, parallel study with weekly randomization)	Modified Knoll Risk Scores for both groups: <4 (range 0-13) Modified Knoll Risk Assessment Tool ranges from 0-33, with a score of ≥ 12 indicating a greater risk for the development of alternations in skin integrity	Low risk	No	<u>Incidence:</u> 1% (1/112) vs. 7% (7/105); p<0.005 Note: For patients that developed ulcers in group B vs. group A, there was significant differences between groups on vascular surgery (p=0.02), previous history of pressure ulcer (p=0.02) and age (p=0.03). Significant difference in incidence of pressure ulcers between groups, even when these factors were controlled (p=0.04) Note: Analysis with only vascular surgery patients, controlled for age and baseline skin assessment and looking at type of device, found a statistical significance associated with device and presence of pressure ulcers (p=0.023)	<u>Severity:</u> 7 patients in group B only developed 11 pressure ulcers (stage of 6 of these could not be determined because of eschar) Grade 1: 1 Grade 2: 4	NR	NR	Poor	Partially funded by an educational grant from MicroPulse

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Berthe, 2007 ⁵⁶	A vs. B Modified Ek score: 1: 42 vs. 47 2: 54 vs. 71 3: 96 vs. 149 4: 465 vs. 805 No significant differences between groups	Low risk	No	A vs. B Incidence of pressure ulcers: 3.2% (21/657) vs. 1.9% (21/1072); RR = 1.63, 95% CI 0.90-2.96)	NR	NR	NR	Poor	NR
Brienza, 2010 ⁵⁷	Mean Braden score: 15.4 (SD \pm 1.4) vs. 15.5 (SD \pm 1.5)	At risk	No	<u>Incidence (number ischial tuberosity pressure ulcers):</u> 0.9% (1/113) vs. 6.7% (8/119), p=0.04 RR = 0.13, 95% CI 0.02-1.04 p=0.054 <u>Incidence (number combined ischial tuberosity and sacral pressure ulcers):</u> 10.6% (12/113) vs. 17.6% (21/119), p=0.14	<u>Severity:</u> Stage 1: 1 Stage 2: 7 Ungradable: 1	NR	NR	Poor	Eunice Kennedy Shriver National Institute on Child Health and Human Development Grant
Collier, 1996 ⁵⁸	Waterlow score range: 3 to 25	Various risk levels	Unclear, but appears prevention is the intention of the study	<u>Incidence:</u> No patients developed a pressure ulcer of any grade during the study	Not relevant	NR	NR	Poor	NR

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Conine, 1993 ⁵⁹	Mean Norton score at baseline: 11.5 vs. 12.1	At risk	No	<u>Incidence:</u> 175 sores in 84/123 patients vs. 184 sores in 85/125 patients, p=NS RR = 1.0, 95% CI 0.84-1.18	A vs. B: <u>Severity:</u> Grade 1: 57% (105/184) vs. 56% (98/175) Grade 2: 24% (45/184) vs. 27% (48/175) Grade 3: 17% (32/184) vs. 15% (27/175) Grade 4: 1% (2/184) vs. 1% (2/175) p=NS	NR	NR	Fair	Department of Health and Welfare Canada National Health Research and Development Program Grant
Conine, 1994 ⁶⁰ Modified sequential randomized trial	Mean Norton score of patients at baseline: 12	At risk	No	<u>Incidence (3 patients):</u> 30/73 vs. 17/68, RR = 0.61, 95% CI 0.37- 1.00; p=0.049	<u>Severity:</u> Grade 1: 77% (20/26) vs. 57% (24/42) Grade 2: 11.5% (3/26) vs. 29% (12/42) Grade 3: 11.5% (3/26) vs. 14% (6/42) p=NS Grade 2 or 3: 8.8% (6/73) vs. 26% (18/68); RR 0.36, 95% CI 0.15 to 0.85	NR	<u>A vs. B</u> Withdrawals due to discomfort: 8% (6/80) vs. 1% (1/83); RR 0.94 (95% CI 0.88 to 1.00)	Fair	NR

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Conine, 1990 ⁶¹ Modified sequential randomized trial	Mean Norton score at baseline (SD; range): 12.9 (2.1;7- 14) vs. 12.4 (2.3;8- 14), p>0.05	At risk	No	<u>Incidence:</u> 133 ulcers in 54% (39/72) patients in group A vs. 148 ulcers in 59% (45/76) patients in group B, p=ns RR = 0.91, 95% CI 0.69-1.21	<u>Severity:</u> Grade 1: 64% (95/133) vs. 41% (91/148) Grade 2: 12% (15/133) vs. 13% (19/148) Grade 3: 24% (33/133) vs. 14% (36/148) Grade 4: 0 vs. 1% (2/148) (p=NS for all)	NR	NR	Fair	British Columbia Health Care Research Foundation
Cooper, 1998 ⁶²	Waterlow score on admission: 17 vs. 16	At risk	No	<u>Incidence:</u> 7% of patients (3/51) developed an ulcer vs. 12% (5/49) of patients developed an ulcer; p=NR	<u>Severity:</u> Only 1 pressure ulcer involved a break in the skin (Stirling grade 2.4, Group A Sofflex group)	NR	NR	Poor	Raymar research grant
Daechsel, 1985 ⁶³	Mean Norton score: 13.4 vs. 13.0	At risk	No	<u>Incidence:</u> 25% (4/16) of patients developed 5 ulcers vs. 25% (4/16) of patients developed 5 ulcers, p=ns RR = 1.0, 95% CI =0.30-3.32; p=ns	<u>Severity:</u> Mean Exton-Smith scores: 2.25 (0.82 SD) vs. 2.75 (0.74 SD), p=0.39	NR	NR	Poor	Gaymar Industries; Pearson Hospital

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Donnelly, 2011 ⁶⁴	Mean Braden score: 14.8 vs. 15 Mean Barthel score: 16.4 vs. 17.4 (p=0.08)	At risk	No	<u>Incidence (number patients):</u> 7% (8/120) of patients vs. 26% (31/119) of patients, p<0.001 RR = 0.26, 95% CI 0.12-0.53; p<0.001 <u>Incidence (number heel, foot, or ankle pressure ulcers):</u> 0% (0/120) vs. 24.4% (29/119); p<0.001	<u>Severity (number pressure ulcers):</u> Grade 1: 0 vs. 18 Grade 2: 4 vs. 16; RR 0.25, 95% CI 0.09 to 0.72 Ungraded: 5 vs. 5 Note: Excluding Grade 1 ulcers did not change results	NR	Adverse events: 20* vs. 23*; p=0.69 (5 deaths, 21 life-threatening, 9 severe, 2 moderate, and 8 mild events - none deemed to be treatment-related) <i>*Denominator unclear; text reported 45 adverse events but only accounted for 43</i>	Good	Special Nursing Research Fellowship funded by the Research and Development Office for Health and Social Care in Northern Ireland
Feuchtinger, 2006 ⁶⁵	A vs. B Norton score preoperatively, mean (SD; range): 22.2 (2.4;13-26) vs. 22.6 (1.9;17-25), p=0.43	Lower risk	Preoperative incidence 2.3% (4 patients had grade 1 pressure ulcers)	<u>Incidence (pressure ulcers):</u> Total post-operative pressure ulcer incidence was 14.3% for both groups; 11.1% vs. 17.6%, p=0.22	<u>Severity:</u> Grade 1 ulcers postoperative days 0-5: 10% (9/90) vs. 15.3% (13/85) Grade 2 ulcers postoperative day 0-5: 1% (1/90) vs. 2.4% (2/85)	NR	NR	Fair	NR
Gebhardt, 1996 ⁶⁶ Cluster trial	Norton score >8: n=5 vs. n=1 Norton score ≤ 8 : n=18 vs. n=19	At risk	No	<u>Incidence (number pressure ulcers):</u> Grade 1: 1 vs. 3 Grade 2: 0 vs. 4 Grade 3: 0 vs. 2 RR = 0.08, 95% CI 0.01-0.56 Excluding Grade I ulcers: RR = 0.06, 95% CI 0.00-0.96	NR	NR	NR	Fair	North East Thames Regional Hospital Board research grant

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Geyer, 2001 ⁶⁷ Pilot randomized trial	Initial Braden score, mean: 12.5 vs. 13.4	At risk	No	<u>Incidence (patients):</u> 40% (6/15) vs. 59% (10/17), p=NS RR = 0.68, 95% CI 0.33-1.42	NR	NR	NR	Fair	National Institute on Disability and Rehabilitation Research grant; authors received "assistance" for the study from ETAC USA, Crown Therapeutics, and Sunrise Medical
Gilcreast, 2005 ⁶⁸	Braden score at baseline not reported for groups, but inclusion of only patients with Braden score ≤ 14	At risk	Not on foot but patients had pressure ulcers on other parts of body	<u>Incidence (heel pressure ulcers; unclear whether the unit was number of ulcers or number of patients):</u> Total 5% (12/240) incidence in both groups over 3 years; 1.68% per year 4% (3/77) vs. 5% (4/87) vs. 7% (5/76), p=0.416	NR	NR	NR	Poor	Tri Service Nursing Research Program grant
Goldstone, 1982 ⁶⁹	Mean Norton score at admission: 13	At risk	Unclear, but states prevention is the intention of the study	<u>Incidence (overall pressure ulcers):</u> 15.6% (5 lesions in 5 patients) vs. 48.8% (35 lesions in 21 patients), p<0.005 RR = 0.32, 95% CI 0.14-0.76 <u>Heel pressure ulcers:</u> 0% vs. 32.6%	<u>Severity</u> Overall maximum width of broken skin (mean): 6.4 mm vs. 29.5 mm, p=0.03 Buttocks maximum width (mean): 5.7 mm vs. 23.9 mm, p=0.018 Sacrum, maximum width (mean): 7.5 mm vs. 56.0 mm, p=NR	NR	NR	Poor	NR
Gray, 1994 ⁷⁰	Waterlow score: 18.03 (3.23 SD) vs. 16.01 (2.58 SD), p=ns	At risk	Unclear, intact skin required, but this may include a grade 1 pressure ulcer	Grade 2 or greater ulcer incidence (number ulcers): 7% vs. 34%, p<0.001	NR	NR	NR, besides comfort	Fair	Research grant from Medical Support Systems

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Gray, 2000 ⁷¹	Waterlow score on admission: 13 vs. 14	At risk	No	Incidence of pressure ulcers: 4% (2/50) vs. 4% (2/50), p=ns	Grade 1: 1 vs. 1 Grade 2: 1 vs. 0 Grade 4: 0 vs. 1	NR	NR	Fair	NR
Gunningberg, 2000 ⁷²	Mean Modified Norton Scale (MNS) at ward admission: 19 vs. 19 % MNS <21: 69% (33/48) vs. 64% (34/53) Score of <21 considered at risk	At risk	No	<u>Incidence (patients):</u> 25% (12/48) vs. 32% (17/53), p=ns	<u>Severity:</u> Grade I: 17% (8/48) vs. 17% (9/53), p=ns Grade II: 8% (4/48) vs. 14% (7/53), p=ns Grade III: 0% (0/48) vs. 0% (0/53), p=ns Grade IV: 0% (0/48) vs. 2% (1/53), p=ns Grade II-IV: 8% (4/48) vs. 15% (8/53), p=ns	NR	NR	Poor	NR. TempurPedic, Fagerdala provided the intervention mattresses
Hofman, 1994 ⁷³ Randomized trial, stopped early	Mean score (per 1985 Dutch consensus meeting criteria): 21 (10.3, 1.6 SD) vs. 23 (10.4, 1.4 SD) High risk	At risk	A vs. B Grade 1 9.5% (2/21) vs. 4.3% (1/23)	<u>Incidence of at least grade 2 ulcers (number patients):</u> 24% (4/17) vs. 68% (13/19), p=0.008% (Includes withdrawals)	Grade 0: 11 vs. 5 Grade 1: 2 vs. 1 Grade 2: 1 vs. 5 Grade 3: 3 vs. 5 Grade 4: 0 vs. 3 p=0.0067 (1985 Dutch consensus meeting grading scale, 0-4)	Mean length of stay: 21 vs. 23 days	NR	Poor	NR

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Hoshowsky, 1994 ⁷⁴ Quasi-experimental study	Baseline NR Adapted Hemphill's Guidelines for Assessment of Pressure Sore Potential (Scale 0- 34, with 0-12 low, 13-25 moderate, 26- 34 high)	Unclear risk	Unclear	<u>Incidence per mattress:</u> Stage I pressure ulcer, A. vs: B: OR 0.16 (95% CI 0.1 to 0.24; p<0.001) C: OR 0.49 (95% 0.34 to 0.72; p<0.001) <u>Incidence per patient characteristics:</u> Age 41-70 years: OR 2.13, CI 1.16 to 3.89, p<0.01 Age >70 years: OR 3.37, CI 1.46 to 7.81, p<0.0005 Vascular disease: OR 2.37, CI 1.10 to 4.89, p<0.02 Hemphill scale rating >4: 2.89, CI 1.25 to 6.69, p<0.01	NR	NR	NR	Poor	NR

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Inman, 1993 ⁷⁵	Unclear, but requirement to be critically ill for inclusion	At risk	Unclear, but prevention is the intention of the study	Incidence* Overall: 16.3% (8/49) vs. 79.6% (39/49); RR 0.21, 95% CI 0.11 to 0.39 Effect of air suspension bed on presence of pressure ulcers: OR 0.18 (0.08- 0.41), p=0.0001 <u>Single pressure ulcers:</u> 12% (6/49) vs. 51% (25/49) <u>Multiple pressure ulcers:</u> 2% (1/49) vs. 24% (12/49) Effect of air suspension bed on presence of pressure ulcers: OR 0.11 (0.02- 0.54), p=0.007 *Estimated from figure. All significant differences.	Incidence* <u>Severe (>1 on Shea grading assessment)</u> <u>pressure ulcers:</u> 4.1% (2/49) vs. 28.6% (14/49) Effect of air suspension bed on presence of pressure ulcers: OR 0.16 (0.06- 0.44), p=0.0005 *Estimated from figure. All significant differences.	Mean length of stay: 18.8 vs. 15.4 days	NR	Fair	Kinetic Concepts Inc, San Antonio, Texas, maker of the KinAir air suspension bed
Jesurum, 1996 ⁷⁶ Quasi-experimental pilot study	Braden score: 9.68 vs. 9.45	At risk		<u>Incidence (number patients), early post- op:</u> 19% (3/16) patients developed 7 ulcers vs. 15% (3/20) patients developed 5 ulcers, p=ns <u>Incidence (number patients), later post- op:</u> 31% (5/16) patients vs. 20% (4/20) patients, p=0.46	<u>Severity (early post-op only):</u> Stage I or II: 3 vs. 1 Stage III or IV: 0 vs. 2	Mean length of stay: 17.0 vs. 21.4 days	NR	Poor	NR

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Jolley, 2004 ⁷⁷ Open label randomized trial	Mean Braden score (range): 15.7 (13- 18) vs. 15.9 (13-18)	At risk	No	<u>Incidence of pressure ulcers (number patients):</u> 9.6% (21/218) of patients developed 27 ulcers vs. 16.6% (37/223) patients developed 58 ulcers Rate ratio 0.42, 95% CI, 0.26 to 0.67)	<u>Incidence of pressure ulcers:</u> All ulcers (grade 1 and 2; no grade 3 or 4 recorded) Number of incident grade 2 ulcers (% of all ulcers): 12 (44%) vs. 20 (34%)	Mean bed days: 7.9 vs. 7.0	<u>A vs. B</u> Withdrawals due to heat- related discomfort: 5% (10/218) vs. 0% (0/223; RR 0.95, 95% CI 0.93 to 0.98	Fair	National Health and Medical Research Council of Australia grant; CSIRO Textile and Fibre Technology, Leather Research Center
Kemp, 1993 ⁷⁸	Mean Braden score on admission (SD): 14.00 (1.73) vs. 13.85 (1.1), p=NS	At risk	No	Incidence (number of patients): 46.7% (21/45) vs. 30.8% (12/39), p=0.18 RR = 0.50, 95% CI 0.28-0.87	<u>Severity:</u> Grade 1: 10 Grade 2: 47	NR	NR	Fair	AARP Andrus Foundation; Gamma Phi Chapter of Sigma Theta Tau International
Lim, 1988 ⁷⁹	Baseline Norton ≤ 14 for inclusion in study Mean Norton score (SD; range) of patients completing trial: 12.3 (1.4;10- 16) vs. 12.3 (1.8;9- 16)	At risk	No	<u>Incidence of ulcers:</u> By ulcer: 35 vs. 37, p>0.05 By patient: 69% (18/26) vs. 73% (19/26), p>0.05	<u>Severity</u> <u>Overall:</u> 60% (44/72) of ulcers were grade 1; none progressed past grade 3 (Exton-Smith scale) <u>number ulcers per group:</u> 35 vs. 37, p>0.05	NR	NR	Fair	Grant from the National Health Research and Development Program, Health and Welfare Canada
McGowan, 2000 ⁸⁰	Mean Braden score: 13.9 vs. 14.01	At risk	No	<u>Incidence:</u> 9% (14/155) patients developed 21 ulcers vs. 30.3% (43*/142) patients developed 67 ulcers, p<0.0001 Rate Ratio 0.28 (95% CI, 0.16 to 0.46) *40 with valid data	<u>Severity</u> Grade 1: All others Grade II: 4 Grade IV: 2 (both in same patient)	NR	Heat-related discomfort reported in unspecified number of group A patients; no incidence in group B (no data reported)	Poor	Sir Edward Dunlop Medical Research Foundation; Nurses Memorial Center Western Australia

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Mistiaen, 2010 ⁸¹	Braden score ≤ 20 : 70% vs. 71%, p=0.79 Braden score ≤ 18 : 47% vs. 47%, p=0.84	At risk	No, free of pressure ulcers at the sacrum at admission	Incidence (number sacral pressure ulcers): 8.9% (24/271) vs. 14.7% (40/272), p=0.035 RR = 0.60, 95% CI 0.37-0.97 After adjustment for baseline patient characteristics, differences between groups shows protective effect of sheepskin: OR 0.53 (95% CI, 0.29 to 0.95) Incidence (number ulcers elsewhere than sacral area; intervention only covers sacral area): 16.4% vs. 15.1%, p=0.69	<u>Severity, number sacral pressure ulcers (EPUAP grades)</u> : Grade 1 = 50 Grade 2 = 12 Grade 3 = 2 p=ns between groups	NR	One-third of group A patients complained of heat-related discomfort, leading to withdrawal for 2/3 of these patients; no incidence in group B (no data reported)	Fair	
Nixon, 1998 ⁸²	Pre-operative Braden score 10-14: 0% (1/222) vs. 0% (0/224) 15-19: 8% (17/222) vs. 10% (23/224) 20-23: 91% (202/222) vs. 89% (200/224)	Lower risk	Unclear, excludes grade 2 or above (may include grade 1)	<u>Incidence (number of patients that failed Torrance scale)</u> : 11% (22/205) vs. 20% (43/211), p=0.01, OR = 0.46 (95% CI 0.26- 0.82)	<u>Severity:</u> 56/65 ulcers conversions of grade 0 to grade 1 4/65 ulcers conversions of grade 0 to grade 2A 5/65 ulcers conversions of grade 0 to grade 2B	NR	NR	Fair	Northern and Yorkshire Regional Health Authority
Russell, 2000 ⁸³	Mean Modified Knoll risk score 3.6 ± 1 vs. 3.8 ± 1 , p=ns The highest attainable score is 33; a score of ≥ 12 indicates a greater risk for altered skin integrity	Lower risk	No	<u>Incidence (number of patients that developed ulcers)</u> : 2.2% (2/98) vs. 7% (7/100), p=NS <u>Incidence (number of ulcers)</u> : 2 vs. 10, p=NR	<u>Severity (number of ulcers)</u> , p=NR Grade 1: 0 vs. 2 Grade 2: 2 vs. 5 Grade 3: 0 vs. 3	NR	<u>A vs. B</u> Adverse events: no difference between groups; no adverse events were treatment- related (no data reported)	Good	MicroPulse, Inc, Portage, Michigan

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Sanada, 2003 ⁸⁴	Mean Braden scale: 12.5 (1.7 SD) vs. 12.1 (1.4 SD) vs. 12.7 (1.7 SD), p=NS	At risk	No	<u>Incidence (number patients that developed pressure ulcers):</u> 3.4% (1/26) vs. 19.2% (5/29) vs. 37.0% (10/27), p<0.01 A vs. B: RR = 0.22, 95% CI 0.03-1.79 A vs. C: RR = 0.10, 95% CI 0.01-0.76	<u>Grade 1 (number ulcers):</u> 0% (0/26) vs. 3% (1/29) vs. 15% (4/27), p=NR <u>Grade 2 (number ulcers):</u> 4% (1/26) vs. 14% (4/29) vs. 22% (6/27), p=NR	NR	NR	Poor	NR
Schultz, 1999 ⁸⁵	Admit Braden score: 22.15 (1.98 SD) vs. 22.41 (1.34 SD)	Lower risk	No	<u>Incidence:</u> 26.7% (55/206) vs. 16.4% (34/207), p=0.0111	<u>Severity, grade 2 or greater (number people):</u> 2.9% (6/206) vs. 1.4% (3/207), p=NR	NR	NR	Good	Partially funded by Devon Industries, in conjunction with the AORN Foundation
Sideranko, 1992 ⁸⁶	Unclear	Unclear risk	No	<u>Incidence (number of patients that developed ulcers):</u> 25% (5/20) vs. 5% (1/20) vs. 12% (2/17), p=NS	NR	Mean length of stay: 10 vs. 9.4 vs. 8.9 days	NR	Poor	NR
Stapleton, 1986 ⁸⁷	Mean Norton scores: 12 vs. 12.8 vs. 12.9	At risk	No	<u>Incidence (number patients that developed ulcers):</u> 34% (11/32) vs. 41% (14/34) vs. 35% (12/34), p=NR <u>Incidence in patients >80 years:</u> 63% (12/19) vs. 32% (7/22), p=0.055 RR = 1.99, 95% CI 0.98-4.00	<u>Severity (Border grading scale):</u> Grade A: 2 vs. 1 vs. 2 Grade B: 9 vs. 5 vs. 8 Grade C: 0 vs. 3 vs. 2 Grade D: 0 vs. 5 vs. 0	NR	NR	Poor	NR
Takala, 1996 ⁸⁸	All patients <8 on Norton Scale	High risk	No	<u>Incidence:</u> 0 vs. 37% (7/19 patients) developed 13 ulcers, p<0.005	Grade 1A: 9 Grade 1B: 4 (all in control group)	NR	NR	Poor	Ahlstrom Medical

Author, year Notes about study design, publication status	Baseline Ulcer Risk Score, p value	Risk Level, Per General Cutoffs*	Baseline Pressure Ulcers, Defined as $\geq 10\%$ of Population? (Y/N/unclear)	Results - Incidence and Characteristics (Number patients with Ulcers or Number Ulcers, varies) A vs. B	Results - Severity (Number Patients with Ulcers or Number Ulcers, varies) A vs. B	Results – Resource Utilization A vs. B	Harms	Quality	Funding Source
Taylor, 1999 ⁸⁹	A vs. B Waterlow score: 19 vs. 17	At risk	Unclear, intact skin but may have grade 1 ulceration	<u>Incidence (number of patients that developed ulcers):</u> 0% (0/22) vs. 9% (2/22), p=NR RR = 0.20, 95% CI 0.01-3.94	Both "superficial"	Mean length of stay: 10.5 vs. 11.6 days	NR	Fair	NR
Theaker, 2005 ⁹⁰	High risk, details NR	High risk	No	<u>Incidence (number of patients that developed ulcers):</u> 10% (3/30) vs. 19% (6/32), p=0.35 RR = 0.53, 95% CI 0.15-1.94	Grade II: 8 Grade III: 1	Mean duration on mattresses: no differences between groups	NR	Fair	NR
Tymec, 1997 ⁹¹	Mean Braden score: 11.8	High risk	Unclear, intact skin on heel, but may have grade 1 ulceration	<u>Incidence (ulcers):</u> 6 vs. 2, p=ns	NR	NR	NR	Poor	EHOB Incorporated provided the Foot Waffles
van Leen, 2011 ⁹²	Norton score between 5-8 at baseline: 61.9% vs. 53.7% Norton score between 9-12 at baseline: 38.1% vs. 46.3%	At risk, high risk	No	<u>Incidence (number patients with ulcers):</u> 4.8% (2/42) vs. 17.1% (7/41), p=0.088 RR = 0.28, 95% CI 0.06-1.26; p=0.0978	<u>Severity (number patients with ulcers):</u> Grade 2: 1 vs. 2 Grade 3: 1 vs. 5	NR	NR	Fair	NR
Vyhldal, 1997 ⁹³	Admission mean Braden scale: 14.7 vs. 14.5, p=0.75	At risk	No	<u>Incidence (number patients with ulcers):</u> 25% (5/20) vs. 60% (12/20), p=0.025 <u>Incidence (number ulcers):</u> 5 vs. 16 RR = 0.42, 95% CI 0.18-0.96	<u>Severity (number patients):</u> Stage 1: 2 vs. 4 Stage 2: 3 vs. 8	NR	NR	Fair	NR. BG Industries (manufacturer) and Baxter Corporation (distributor) provided the MAXIFLOAT mattresses for the study.

Abbreviations: BMI, body mass index; CI, confidence interval; NR, not reported; NS, not significant; RR, relative risk.

*Pressure Ulcer Risk Assessment general cutoffs for at risk: Braden scores <15-18. Lower scores indicate higher pressure ulcer risk. Cubbin and Jackson score <29. Lower scores indicate higher pressure ulcer risk. Norton scores <12-16. Lower scores indicate higher pressure ulcer risk. Waterlow scores >10-15. Higher scores indicate higher pressure ulcer risk.

Appendix H12. Key Question 3: Quality Assessment of Support Surfaces Trials

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to follow-up: differential/ high	Intention-to-treat analysis	Quality rating
Andersen, 1982 ⁵⁴	Unclear	Unclear	Yes	Yes	No	No	No	Yes	Differential: No High: Yes	No	Poor
Aronovitch, 1999 ⁵⁵	No; by week	Unclear	Yes; group differences on diagnosis, and type of surgeries but otherwise comparable	Yes	Unclear	No	Unclear	Yes	No/No	No	Poor
Berthe, 2007 ⁵⁶	Unclear	No	Unclear	Yes	No	No	No	Yes	No	Yes	Poor
Brienza, 2010 ⁵⁷	Yes 1:1 allocation randomization scheme stratifying according to clinical facility	Unclear	Yes for gender, age, race and Braden score. Lower rates of ambulation in pts in the intervention group, p= .03.	Yes	Unclear	No	No	Yes	Unclear/Yes 21% and 24%	Yes	Poor
Collier, 1996 ⁵⁸	Unclear	Unclear	Unclear	No	No	Unclear	Unclear	Yes	No	No	Poor
Conine, 1990 ⁶¹	Unclear	No	Yes	Yes	Yes	No	No	Yes	No/No	No	Fair
Conine, 1993 ⁵⁹	Unclear	No	Yes	Yes	Yes	Unclear	Unclear, cushion covered with identical polyester covers but not stated that patients were masked	Yes	No/No	No	Fair
Conine, 1994 ⁶⁰	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes (more people, 6 vs. 1, dropped out from the intervention group due to discomfort, p=0.05)/No	No	Fair
Cooper, 1998 ⁶²	Unclear	Yes	Yes	Yes	No	No	No	Yes	No	No	Poor
Daechsel, 1985 ⁶³	Unclear	Unclear	No; not age or sex	Yes	Unclear	No	No	Yes	No	Yes	Poor
Donnelly, 2011 ⁶⁴	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Fair

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to follow-up: differential/high	Intention-to-treat analysis	Quality rating
Feuchtinger, 2006 ⁶⁵	Unclear	Unclear	Yes; significant difference in presence of renal insufficiency between groups but otherwise comparable	Yes	Yes	Yes	Yes	No	No	Yes	Fair
Gebhardt, 1996 ⁶⁶	Yes	Unclear	Yes; Differences between groups on cancer diagnosis, breathlessness, and medications but otherwise comparable	Yes	Unclear	No	No	Yes	No	No	Fair
Geyer, 2001 ⁶⁷	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Fair
Gilcreast, 2005 ⁶⁸	Yes; Shuffled unmarked cards	Yes; identical sealed envelopes used	No; significant difference in distribution of sexes between groups	Yes	No	No	No	Yes	Unclear/Yes	No	Poor
Goldstone, 1982 ⁶⁹	No	No	Yes	Yes	No	No	No	No	Unclear	No	Poor
Gray, 1994 ⁷⁰	Unclear	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Fair
Gray, 2000 ⁷¹	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Fair
Gunningberg, 2000 ⁷²	Unclear	Unclear	No	Yes	No	No	No	Yes	No	Yes	Poor
Hofman, 1994 ⁷³	No	Unclear	Yes	Yes	No	No	No	Yes	No/Yes (~20% from each group)	No	Poor
Hoshowsky, 1994 ⁷⁴	Unclear, and convenience sample	Unclear	Yes; patients served as their own controls	Yes	No	No	Unclear	Yes	No	Yes	Poor
Inman, 1993 ⁷⁵	Yes	Unclear	Yes	Yes	Unclear	Unclear	Unclear	Yes	No/No	No	Fair
Jesurum, 1996 ⁷⁶	Unclear	Unclear	No; Intervention group more females	Yes	Unclear	No	No	Yes	No	No	Poor
Jolley, 2004 ⁷⁷	Yes; Shuffled cards in envelopes	Yes	Yes; more emergency admissions in intervention but otherwise comparable	Yes	No	No	No	Yes	No/No	No	Fair

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to follow-up: differential/high	Intention-to-treat analysis	Quality rating
Kemp, 1993 ⁷⁸	Yes	Unclear	Yes	Yes	Unclear	No	No	Yes	No	Yes	Fair
Lim, 1988 ⁷⁹	Unclear	Unclear	Yes	Yes	Yes	No	No	Yes	No	No	Fair
McGowan, 2000 ⁸⁰	Unclear	Yes	No; more males and knee replacement patients in intervention group	Yes	No	No	No	Yes	No	No	Poor
Mistiaen, 2010 ⁸¹	Yes, randomization scheme was created in SPSS	Yes	Yes	Yes	No	No	No	No	No	Yes	Fair
Nixon, 1998 ⁸²	Yes	Yes	Unclear	Yes	Yes	No	No	Yes	No	Unclear	Fair
Russell, 2000 ⁸³	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Fair
Sanada, 2003 ⁸⁴	Unclear	Yes	Yes; Systolic blood pressure higher in one-cell mattress group	Yes	No	No	No	Yes	Yes; 24.1% attrition	No	Poor
Schultz, 1999 ⁸⁵	Yes	Yes	Yes	Yes	Yes	Yes	Yes, mattress covered with a sheet	Yes	No	Yes	Good
Sideranko, 1992 ⁸⁶	Unclear	Unclear	Yes	Yes	Unclear	No	No	No	Unclear	Unclear	Poor
Stapleton, 1986 ⁸⁷	No	No	Yes	Yes	Unclear	No	No	Yes	No	No	Poor
Takala, 1996 ⁸⁸	Unclear	Unclear	Yes	Yes	Unclear	No	No	Yes	Yes/Yes 35-45%	Yes	Poor
Taylor, 1999 ⁸⁹	Unclear	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Fair
Theaker, 2005 ⁹⁰	Unclear	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Fair
Tymec, 1997 ⁹¹	Yes	Unclear	Unclear	Yes	Unclear	No	No	No	Unclear	Unclear	Poor
van Leen, 2011 ⁹²	Unclear	Yes	No; Intervention group higher risk	Yes	Unclear	No	No	Yes	No	Yes	Fair
Vyhliadal, 1997 ⁹³	Yes	Yes	No	Yes	Unclear	No	No	Yes	No	Yes	Fair

Appendix H13. Key Question 3: Data Extraction of Nutrition Trials

Author, Year	Study Design	Setting Country	Eligibility Criteria and Exclusions	Study Duration of Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup
Bourdel-Marchasson, 2000 ⁹⁴	Randomized trial (cluster)	Multicenter, hospitals France	>age 65 in acute phase of critical illness, unable to move themselves, unable to eat independently at admission and without pressure ulcers Ward inclusion: >40% of inpatients on ward were older than 65 years; included wards had to demonstrate involvement / participate in pressure ulcer prevention training program (changing positions, special mattresses, cleaning care)	15 days or until death or discharge	35 wards selected that met age inclusion criteria; 19 wards then participated in pressure ulcer prevention program and were therefore selected to participate; 672 patients included (295 intervention, 377 control); unclear how many excluded	Not reported	Not reported
Houwing, 2003 ⁹⁵	Randomized trial	Hospitals The Netherlands	Post-operative patients (n=103) s/p hip fracture with CBO PU risk score >8 Exclusion: terminal care, metastatic hip fracture, insulin-dependent diabetes, renal disease, hepatic disease, morbid obesity, pregnancy or lactation	28 days or until discharge	NR/103/103	None	None
Delmi, 1990 ⁹⁶	Randomized trial	Orthopaedic unit of the University hospital of Geneva and "second (recovery)" hospital	Elderly patients > 60 years old, mean age 82) with femoral neck fractures after accidental fall; exclusion: fractures from violent external trauma, pathological fractures (tumors, non-osteoporotic osteopathies), patients with overt dementia or hepatic, renal or endocrine disease, gastrectomy or malabsorption, or treatment with phenytoin, steroids, barbiturates, fluoride, or calcitonin	Supplement given throughout hospital stay (mean 32 days); measurements at admission, day 14, 21, 28, at discharge from convalescent hospital, and at 6 months	NR/59/59	Unclear whether withdrawal or loss to follow up; analyzed 59 at admission, 24 at recovery hospital, and 53 at 6 months	Unclear whether withdrawal or loss to follow up; analyzed 59 at admission, 24 at recovery hospital, and 53 at 6 months

Author, Year	Intervention	Baseline Demographics (Age, Sex, Race)	Ulcer Risk	Results	Harms	Quality	Funding Source
Bourdel-Marchasson, 2000 ⁹⁴	<p>A: Nutritional intervention group (n=295): standard diet (1.8 kcal/d) and 2 oral supplements per day (with 200 mL; 200 kcal, 30% protein; 20% fat; 50% carbohydrate; minerals and vitamins such as 1.8 mg zinc and 15 mg vitamin C)</p> <p>B: Control group (n=377): standard diet (1.8 kcal/day). nutritional intervention implemented up to 15 consecutive days or until discharge or death</p>	<p>A vs. B Mean age: 83.6 vs. 83.0 years Sex: 67.5% vs. 63.1% female Race: NR</p> <p>672 patients older than 65 in acute phase of critical illness; intervention group included more patients with stroke, heart failure, and dyspnea and fewer with antecedent falls, delirium, lower limb fractures and digestive disease.</p>	<p>A vs. B Norton Score (%): 5-10: 28.5% vs.35.5% 11-14: 40.3% vs.46.9% >14: 31.2% vs. 18.6%</p> <p>Nutritional intervention group had lower baseline Norton score, were less dependent (Kuntzman score), and had a lower serum albumin</p>	<p>A vs. B Cumulative incidence:40% vs.48% RR: 0.83 (95% CI 0.7-0.99); adjusted RR 0.64 (95% CI 0.42 to 0.97)</p> <p>Proportion of erythema 90% for both groups, no significant (p value NR) differences in development of erythema between two groups</p>	NR	Poor	Projet hospitalier de recherche clinique, ministere de la sante et de l'action humanitaire, derECTION generale de la sante and direction dex hopitaux
Houwing, 2003 ⁹⁵	<p>A: Nutritional supplement (400 mL; 500 kcal; 40 g protein; 6 g L-arginine; 20 mg zinc; 500 mg vitamin C; 200 mg vitamin E; 4 mg carotenoids) (n=51) by mouth daily</p> <p>B: Non caloric, water-based placebo (n=52) by mouth daily</p>	<p>A vs. B Mean age 81.5 +/- 0.9 vs. 80.5 +/- 1.3 (p=0.528) Sex: 78% vs. 84% female (p = 0.456) Race: NR</p>	<p>A vs. B CBO risk assessment score: 11.1 +/- 0.3 vs.11.2 +/- 0.2 (p=0.629)</p>	<p>A vs. B Incidence of grade 1 ulcers: 35.3% (18/51) vs. 57.7% (30/52); RR 0.92, 95% CI 0.65 to 1.3</p> <p>Incidence of grade 2 ulcers: 17.6% (9/51) vs. 26.9% (14/52); RR = 0.66, 95% CI 0.31-1.38</p>	NR	Poor	Numico Research BV, Wageningen, the Netherlands
Delmi, 1990 ⁹⁶	<p>A: Standard hospital diet with daily oral nutrition supplement (250 mL; 254 kcal; 20.4 g protein; 29.5 g carbohydrate; 5.8 g lipid; 525 mg calcium; 750 IU vitamin A; 25 IU vitamin D3, vitamins E, B1, B2, B6, B12, C, nicotinamide, folate, calcium pantothenate, biotin, minerals), started on admission, continued throughout second hospital (mean period 32 days); given at 8 PM daily (n=27)</p> <p>B: Standard hospital diet (n=32)</p>	<p>A vs. B Mean age 80.4 +/- 8.5 vs. 82.9 Sex: 88.9% vs. 90.6% female Race: NR Other categories similar except 25-hydroxyvitamin D plasma level slightly lower in non-supplemented patients; of note, all patients nutritionally at risk with below normal values for baseline retinol binding protein, vitamin A, carotene, triceps skinfold, upper arm circumference</p>	Not measured; most patients had nutritional deficiencies on admission	<p>A vs. B Incidence at discharge: 0% (0/9) vs. 20% (3/15); RR 0.79, 95% CI 0.14 to 4.4). At Incidence at 6 months: 0% (0/25) vs. 7% (2/27); RR 0.23, 95% CI 0.01 to 4.3) Clinical outcome was significantly better; rate of complications/ mortality and length of hospital stay was significantly lower in the supplemented group.</p>	NR	Poor	NR

Abbreviations: CBO, Dutch Institute for Health Care Improvement; CI, confidence interval; IU, international units; NR, not reported; PU, pressure ulcer; RR, relative risk.

Appendix H14. Key Question 3: Quality Assessment of Nutrition Trials

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to followup: differential/high	Intention-to-treat analysis	Quality
Bourdel-Marchasson, 2000 ⁹⁴	Unclear	Unclear	No; Nutritional intervention group had lower baseline Norton score, were less dependent (Kuntzman score), and had a lower serum albumin; intervention group included more patients with stroke, heart failure, and dyspnea and fewer with antecedent falls, delirium, lower limb fractures and digestive disease.	Unclear	Unclear	Unclear	No	Unclear	Unclear	Unclear	Poor
Houwing, 2003 ⁹⁵	Unclear	Unclear	Yes	Yes	Unclear	Unclear	Unclear; different taste of supplements	Yes	No	Unclear	Poor
Delmi, 1990 ⁹⁶	Unclear	Unclear	Yes	Yes	Unclear	No	No	Yes	Yes; varied between 12-60% (at 6 months and during second hospital stay)	Unclear	Poor

Appendix H15. Key Question 3: Data Extraction of Repositioning Trials

Author, Year	Study Design	Setting Country	Eligibility Criteria and Exclusions	Study Duration of Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention
Defloor, 2005 ⁹⁷	Randomized trial	11 elder-care nursing homes Belgium	Braden score <17 or Norton score <12, informed consent	8 weeks (4 weeks of one intervention, followed by re-randomization and another 4 week intervention)	1,952 screened/838 eligible/262 enrolled in intervention groups and 576 to control	0	0	A: Usual care B: 2-hour turning C: 3-hour turning D: 4-hour turning E: 6-hour turning
Moore, 2011 ⁹⁸	Randomized trial (cluster)	12 long-term care facilities Ireland	Patients aged >65 years, at risk of pressure ulcer development according to Braden score, no prevalent pressure ulcers, and no medical condition that would preclude repositioning	28 days	270 screened/213 enrolled	6 (3 patients in each group died)	0	A: Repositioning at 30 degree tilt every 3 hours during the night B: Repositioning at 90 degree lateral every 6 hours during the night
Young, 2004 ⁹⁹	Randomized trial	Hospital (acute ward) United Kingdom	Elderly Caucasian patients at risk of pressure ulcer development, without existing ulcers, able to lie in 30 degree tilt position	1 night	46 enrolled	7 (5 in experimental group unable to tolerate intervention, 2 in control group died overnight)	0	A: 30 degree tilt repositioning B: Standard repositioning

Author, year	Baseline Demographics (Age, Sex, Race)	Ulcer Risk	Results	Harms	Quality	Funding Source	Comments
Defloor, 2005 ⁹⁷	A vs. B vs. C vs. D vs. E Mean age: 84 vs. 85 vs. 85 vs. 85 vs. 85 Sex: 78.3% vs. 88.9% vs. 87.9% vs. 81.8% vs. 77.8% female Race: NR	A vs. B vs. C vs. D vs. E Mean Braden score: 13.2 vs. 13.3 vs. 13.2 vs. vs. 13.1 vs.13.0 Mean Norton score: 10.1 vs. 10.4 vs. 9.6 vs. 9.8 vs. 9.5	A vs. B vs. C vs. D vs. E Grade 1 pressure ulcer incidence: 43.0% (220/511) vs. 47.6% (30/63) vs. 44.8% (26/58) vs. 42.4% (28/66) vs. 46.0% (29/63) Grade 2 or greater pressure ulcer incidence: 20% (102/511) vs. 14.3% (9/63) vs. 24.1% (14/58) vs. 3% (2/66) vs. 15.9% (10/63); p=0.002 D vs. A, B, C, or E Pressure ulcer occurrence odds: OR 0.12 (95% CI 0.03-0.48) Time to pressure ulcer development: log rank test = 13.3, df=4, p=0.001)	NR	Good	NR	
Moore, 2011 ⁹⁸	Age: 53% between 81 and 90 years, 13% between 91 and 100 years Sex: 79% female	NR	A vs. B Incident pressure ulcers: 3% (3/99) vs. 11.4% (13/114); RR 0.27, 95% CI 0.08 to 0.93; IRR = 0.27 (95% CI 0.08-0.93); OR = 0.243 (95% CI 0.067-0.879; p=0.034)	NR	Fair	Health Research Board of Ireland Clinical Nursing & Midwifery Research Fellowship	
Young, 2004 ⁹⁹	A vs. B Mean age: 70.1 vs. 70.5 years Sex: 50% vs.50% female Race: 100% White	A vs. B Mean Waterlow score: 20 vs.20	A vs. B Incidence of non-blanching erythema: 13% (3/23) vs. 9% (2/23); RR = 1.50 (95% CI 0.28-8.16)	21.7% (5/23) could not tolerate intervention	Fair	NR	38% vs. 18% nursed on low-air-loss mattresses 15% drop-out rate, more than half of patients spontaneously repositioned themselves between turnings

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; NR, not reported; OR, odds ratio; RR, relative risk.

Appendix H16. Key Question 3: Quality Assessment of Repositioning Trials

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to follow up: differential/high	Intention-to-treat analysis	Quality rating
Defloor, 2005 ⁹⁷	Yes; computerized randomization tables	Yes; sealed envelope	Yes	Yes	Yes	No	No	Yes	No	Unclear	Good
Moore, 2011 ⁹⁸	Yes; computerized	Yes; distance randomization	Yes	Yes	Unclear	No	No	Yes	No	Yes	Fair
Young, 2004 ⁹⁹	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Fair

Appendix H17. Data Extraction of Dressing Trials

Author, Year	Study Design	Setting Country	Eligibility Criteria and Exclusions	Study Duration of Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup
Fader, 2003 ¹⁰⁰	Randomized trial (cross-over)	Nursing and residential homes for older people with physical and mental disabilities United Kingdom	Females, aged >65, residing in nursing home, using incontinence pads for heavy incontinence every night Exclusion: Incontinent of feces 3 or more times per week; unable to comply with measurement; affected by skin condition of the groins, upper thighs, or buttocks; or with a grade 2 pressure ulcer; non- Caucasian or with pigmented skin in measurement area; in the terminal phase of an illness; or acutely ill	2-week baseline period followed by two 4-week interventions	81 enrolled	0	0
Nakagami 2007 ¹⁰¹	Experimental bilateral comparison study (intervention randomized to right or left trochanter)	Long-term care facility Japan	Inclusion: aged ≥ 65, Braden score < 15 Exclusion: impaired judgment, lack of consciousness, presence or pressure ulcer/skin disorder in study area, poor general medical conditions, inability to position body in either a left or a lateral position	4 weeks	NR/37/37	A vs. B: NR Total = Death: 5.4% (2/37) Pruritus: 2.7%	A vs. B: NR

Author, Year	Intervention	Baseline Demographics (Age, Sex, Race)	Ulcer Risk	Results	Harms	Quality	Funding Source
Fader, 2003 ¹⁰⁰	A: Incontinence pad changing at 10pm, 2am, and 6am B: Incontinence pad changing at 10pm and 6am	Mean age: 85.2 years 100% female	Mean Norton score: 11 Mean Braden score: 13	A vs. B Incident pressure ulcers: 0 vs. 5 (OR not reported, but 95% CI 0-1.09); p=0.1	NR	Fair	NHS Research and Development grant
Nakagami 2007 ¹⁰¹	A vs. B: NR Mean age: 86.4 (± 8.2) % women: 75.7 % non-white: NR	A vs. B: NR Mean Braden Score: 10.4 ± 1.2	A: REMOIS PAD (dressing with a skin adhesive layer (hydrocolloid), a support layer (urethane film), outer layer of multifilament nylon fibers, .45 mm thick, oval 10 cm x 7 cm) B: No dressing	A vs. B Incidence of Persistent Erythema: 5.4% (2/37) vs. 29.7% (11/37), p = .007, RR of the PPD = 0.18 (95% CI: 0.5-0.73), Number needed to treat = 4.11 (95% CI: 2.50-11.63)	Safety of direct application of PPD tested, 1 pt. developed pruritus around the dressing, no severe product-related complications observed.	Poor	Dressing provided by ALCARE Corp., funded by a Ministry of Education, Culture, Sports, Science and Technology, Japan

Abbreviations: CI, confidence interval; NHS, National Health Service; NR, not reported; OR, odds ratio; PPD, pressure ulcer preventive dressing; RR, relative risk.

Appendix H18. Quality Assessment of Dressing Trials

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to followup: differential/high	Intention-to-treat analysis	Quality rating
Fader, 2003 ¹⁰⁰	Yes; coin toss	Unclear	Yes	Yes	Yes	No	No	Yes	No	Yes	Fair
Nakagami, 2007 ¹⁰¹	No	No	NA	Yes	No	No	No	No	No	Yes	Poor

Appendix H19. Key Question 3: Data Extraction of Other Intervention Trials

Author, Year	Study Design	Setting Country	Eligibility Criteria and Exclusions	Study Duration of Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention
Barton, 1976 ¹⁰²	Randomized trial	Hospital England	NR 65+, no evidence of pressure sores at the time of operation	NR	NR/NR/85	NR	NR	A: 80 IU of corticotropin in a gelatin solvent, administered intramuscularly B: 80 IU gelatin solvent, administered intramuscularly
Scott, 2001 ¹⁰³	Randomized trial	A single acute-care National Health Service trust United Kingdom	Patients aged ≥ 40 years, scheduled to undergo major surgery with an expected hospital stay of five days, with no existing sacral pressure ulcers Exclude: Patients whose procedure uses intraoperative warming as standard practice, or requires patients to use a lateral or prone position	NR (conducted over 21 months, each patient hospitalized at least 5 days)	338 enrolled/324 analyzed	14 (5 changed surgical procedure, 6 cancelled surgery, 3 due to communication breakdown)	0	A: Forced-air warming therapy and warming of all IV fluids B: Usual care included regulation of ambient temperature, minimal exposure, and availability of warming blankets immediately post-operative

Author, Year	Baseline Demographics (Age, Sex, Race)	Ulcer Risk	Results	Harms	Quality	Funding Source
Barton, 1976 ¹⁰²	NR	NR	<p>A vs. B Incidence of PU: 11.9% (5/42) vs. 27.9% (12/43), RR = 0.43 (95% CI 0.16-1.11)</p> <p>A vs. B Incidence of PU by operation type: Hip replacement: 0% (0/16) vs. 31% (5/16) p= statistically significant Fractured femur: 19% (5/26) vs. 26% (7/27)</p>	No complications observed	Poor	Armour Pharmaceutical Co. Limited
Scott, 2001 ¹⁰³	<p>A vs. B Mean age: 68.4 vs. 68.2 years Sex: 54% vs. 54% female Race: NR</p>	<p>A vs. B Mean BMI: 26.7 vs. 26.7 Diabetes: 10.6% vs. 7.4% Heart disease: 25% vs. 17.2% (p=0.09)</p>	<p>A vs. B Pressure ulcer incidence: 5.6% (9/161) vs. 10.4% (17/163); RR 0.54 (95% CI 0.25 to 1.2) Absolute risk reduction = 4.8% Relative risk reduction: 46% NNT: 21 (95% CI no effect-10)</p>	NR	Fair	Augustine Medical; NHS Executive

Abbreviations: BMI, body mass index; CI, confidence interval; IU, international unit; IV, intravenous; NHS, National Health Service; NNT, number needed to treat; NR, not reported; RR, relative risk.

Appendix H20. Key Question 3: Quality Assessment of Other Intervention Trials

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to followup: differential/high	Intention-to-treat analysis	Quality rating	Comment
Barton, 1976 ¹⁰²	Unclear	Unclear	Unclear	No	Unclear	Unclear	Yes	No	Unclear	Unclear	Poor	Preliminary communication, many details missing
Scott, 2001 ¹⁰³	Unclear; "block randomization system" undescribed	Yes; opaque envelopes	Yes	Yes	Yes	No	No	Yes	No	Yes; less than 5% unanalyzed	Fair	

Appendix H21. Data Extraction of Lotion Trials

Author, year	Study design	Setting Country	Eligibility criteria & exclusions	Study Duration of Follow up	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention
Cooper, 2001 ¹⁰⁴	Randomized trial	5 long-term care facilities United Kingdom	Urinary and/or fecal incontinence	14 days	93/93/87 (66 no pressure ulcer at baseline)	6% (6/93)	None; withdrawn patients excluded from analysis	A. Clinisan cleanser (includes silicone, triclosan, benzylicum and emolients) B. Standard hospital soap
Declair, 1997 ¹⁰⁵	Randomized trial	Intensive care unit Brazil	NR	Mean of 21 days	NR/NR/86	NR	NR	A: 1.6gm EFA with linoleic acid extracted from sunflower oil, 112 IU Vitamin A, and 5 IU Vitamin E B: 1.6 gm mineral oil, 112 IU Vitamin A, and 5 IU Vitamin E
Duimel-Peeters, 2007 ¹⁰⁶	Randomized trial (cross-over)	8 nursing homes Holland	Patients with light skin color, residing in nursing home for more than 2 months, resting on an anti-pressure-ulcer mattress, and at a high risk of pressure ulcers using a Braden cutoff of 20 Exclude: Patients already treated with massage for another purpose, undergoing surgery in near future or in prior 2 weeks, prevalent pressure ulcers at coccyx, heels, or ankles, expected short length of stay, or life expectancy less than 10 months	Two treatment periods of 4 weeks, separated by a 2-week washout period	79 eligible/79 enrolled	0	0	A: 2-3 minute massage with an indifferent cream, and repositioning every 6 hours B: 2-3 minute massage with a 5% dimethyl sulfoxide cream, and repositioning every 6 hours C: Repositioning every 6 hours
Houwing, 2008 ¹⁰⁷	Randomized trial	8 nursing homes Holland	Patients resting on an anti-pressure-ulcer mattress, at high risk of developing pressure ulcers according to Braden score <20 Exclude: Patients treated with other ointments or creams, who had were scheduled to have surgery or had undergone surgery in previous 2 weeks, with existing pressure ulcers, or with dark skin	4 weeks	79 enrolled	0	0	A: 30 degree tilt repositioning every 6 hours B: 30 degree tilt repositioning every 6 hours, plus 3-minute massage of the buttock, heel, and ankle with an indifferent cream every 6 hours C: 30 degree tilt repositioning with massage using 5% dimethyl sulfoxide cream

Author, year	Study design	Setting Country	Eligibility criteria & exclusions	Study Duration of Followup	Number Screened/ Enrolled/ Analyzed	Withdrawals	Loss to Followup	Intervention
Smith, 1986 ¹⁰⁸	Randomized trial	6 Long-term care facilities United Kingdom	Exclusion: existing PU	24 weeks (6 months)	NR/258/258	A vs. B Redness: 2.3% (3/129) vs.0.8% (1/129) Rash: 0% (0/129) vs.0.8% (1/129) Shingles: 0.8% (1/129) vs.0% (0/129) Non compliance: 0% (0/129) vs.0.8% (1/129) Death: 16.3% (21/129) vs. 19.4% (25/129)	A vs. B Transfer: 0% (0/129) vs.1.6% (2/129)	A: Conotrane (20% dimethicone 350 and .05% hydrargaphen)B: Unguentum (description NR)
van der Cammen, 1987 ¹⁰⁹	Randomized trial	Hospital (geriatric wards) United Kingdom	Chair bound patients with Norton scores between 5 and 14, without prevalent ulcers, no severe or terminal illness, and an expected stay of 3 or more weeks	3 weeks	NR/120/104	16 (6 in Prevasore group and 10 in Dermalex group; 8 deaths, 6 discharges, 1 transfer, 1 wet sore)	0	A: Prevasore cream B: Dermalex cream

Author, year	Baseline Demographics (Age, Sex, Race)	Ulcer Risk	Results	Harms	Quality	Funding Source
Cooper, 2001 ¹⁰⁴	A vs. B Mean age 85 vs. 79 years 80% vs. 55% female Race not reported Duration of hospitalization 1.72 vs. 0.38 years	Stirling Pressure Sore Severity Scale used to assess risk; baseline scores not reported	A vs. B, incidence of erythema or broken skin (results limited to 33 patients with no baseline erythema or pressure ulcer): 18% (6/33) vs. 42% (14/33); p=0.06 RR 0.43 (95% CI 0.19 to 0.98)	One case of blistering in a Group B patient; determined not to be study related	Fair	Venture Healthcare
Declair, 1997 ¹⁰⁵	A vs. B: NR Mean age: 60 vs. (range 26-78) % women: NR % nonwhite: NR	A vs. B: NR Norton score: 9 (all patients.)	A vs. B incidence of PU: 4.6% (2/43) vs. 27% (12/43); RR = 0.17 (95% CI 0.04-0.70) A vs. B PU incidence according to severity: Grade I: 4.6% (2/43) vs. 0% (0/43) Grade II: 0% (0/43) vs. 27% (12/43); RR = 0.04 (95% CI 0.00-0.66)	NR	Poor	NR
Duimel-Peeters, 2007 ¹⁰⁶	Mean age: 81.3 years Sex: 69.6% (55/79) female Race: NR	Mean BMI: 21.7	A vs. B vs. C <u>Treatment period 1</u> Incident ulcers: 41.9% (13/31) vs. 62.1% (18/29) vs. 38.9% (7/18); p=0.189 AOR: 1.14 (p=0.834) vs. 2.57 (p=0.126) vs. 0.64 (p=0.35) <u>Treatment period 2</u> Incident ulcers: 13.6% (3/22) vs. 12.0% (3/25) vs. 5.9% (1/17); p = 0.726 AOR: 2.53 (p=0.441) vs. 2.18 (p=0.516) vs. 0.06 (p=0.007)	NR	Fair	NR
Houwing, 2008 ¹⁰⁷	A vs. B vs. C Median age: 81.5 vs. 85 vs. 80.5 Sex: 82.3% vs. 75% vs. 72.1% female Race: NR	NR	A vs. B vs. C Incidence of pressure ulcers, all locations: 38.9% (7/18) vs. 31.3% (10/32) vs. 62.1% (18/29); OR = 3.89 (95% CI 1.41-10.7) Incidence of pressure ulcers, buttocks: 33.3% (6/18) vs. 21.9% (7/32) vs. 37.9% (11/29) Incidence of pressure ulcers, heel/ankle: 16.6% (3/18) vs. 15.6% (5/32) vs. 55.1% (16/29); OR = 8.80 (95% CI 2.61-29.6)	Higher incidence of pressure ulcers in intervention group than control	Fair	NR
Smith, 1986 ¹⁰⁸	A vs. B Mean age: 82 years (63-98) vs. 83 years (69-102) % women: 80.6% vs. 82.2% % nonwhite: NR	NR	A vs. B Incidence of PU by patient. 27.1% (35/129) vs. 36.4% (47/129), RR = 0.74, 95% CI 0.52-1.07 Total incidence of PU: 84 vs. 109, p < 0.05 By severity score*: Grade I: 5.4% (7/129) vs. 8.5% (11/129) p=NR Grade II: 17.8% (23/129) vs. 24.0% (31/129) p=NR Grade III: 3.9% (5/129) vs. 3.1% (4/129) p=NR Grade IV: 0% (0/129) vs. 0.8% (1/129) p=NR	11 patients developed redness of skin and/or rash, only 5 withdrew.	Poor	W.B. Pharmaceuticals

Author, year	Baseline Demographics (Age, Sex, Race)	Ulcer Risk	Results	Harms	Quality	Funding Source
van der Cammen, 1987 ¹⁰⁹	A vs. B Mean age: 82.2 vs. 82.9 years Sex: 74% vs. 74% female Race: NR	A vs. B Mean Norton score at entry: 11.4 vs. 11.5 Mean Norton score at 3 weeks: 13.4 vs. 13.9	A vs. B Direct comparisons between treatment groups was not significant (data not shown) By the end of week 3, 13% of Prevasore patients and 22% of Dermalex patients showed skin deterioration and pressure ulcers (RR = 0.59, 95% CI 0.25-1.40)	Wet sore developed in one group, possibly related to treatment (does not report which group)	Poor	NR

Abbreviations: AOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; EFA, essential fatty acids; IU, international unit; NR, not reported; OR, odds ratio; PU, pressure ulcer; RR, relative risk.

*Grading according to Barbenel, 1977¹¹⁰: Grade I - skin intact; Grade II - superficial sore; Grade III - skin destruction without cavity; Grade IV - Skin destruction with cavity.

Appendix H22. Quality Assessment of Lotion Trials

Author, Year	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Reporting of attrition	Loss to followup: differential/high	Intention-to-treat analysis	Quality rating	Comment
Cooper, 2001 ¹⁰⁴	Unclear	Yes	No (gender; length of stay)	Yes	Yes	No	No	Yes	No	Yes	Fair	
Declair, 1997 ¹⁰⁵	Unclear	Unclear	Unclear	No	Yes	Yes	Yes	No	Unclear	Unclear	Poor	
Duimel-Peeters, 2007 ¹⁰⁶ (Same study population as Houwing, 2008 ¹⁰⁷)	Yes; dice throw (cluster randomization)	No	Yes	Yes	No	No	No	Yes	No	No	Poor	No assessment of cluster correlation
Houwing, 2008 ¹⁰⁷ (Same study population as Duimel-Peeters, 2007 ¹⁰⁶)	Yes; dice throw (cluster randomization)	No	Yes	Yes	No	No	No	Yes	No	Yes	Poor	No assessment of cluster correlation
Smith, 1986 ¹⁰⁸	Unclear	Unclear	Unclear	No	Unclear	Yes	Yes	No	Yes	Yes	Poor	
van der Cammen, 1987 ¹⁰⁹	Unclear	Unclear	Yes	Yes	Unclear	No	No	Yes	No	No	Poor	

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