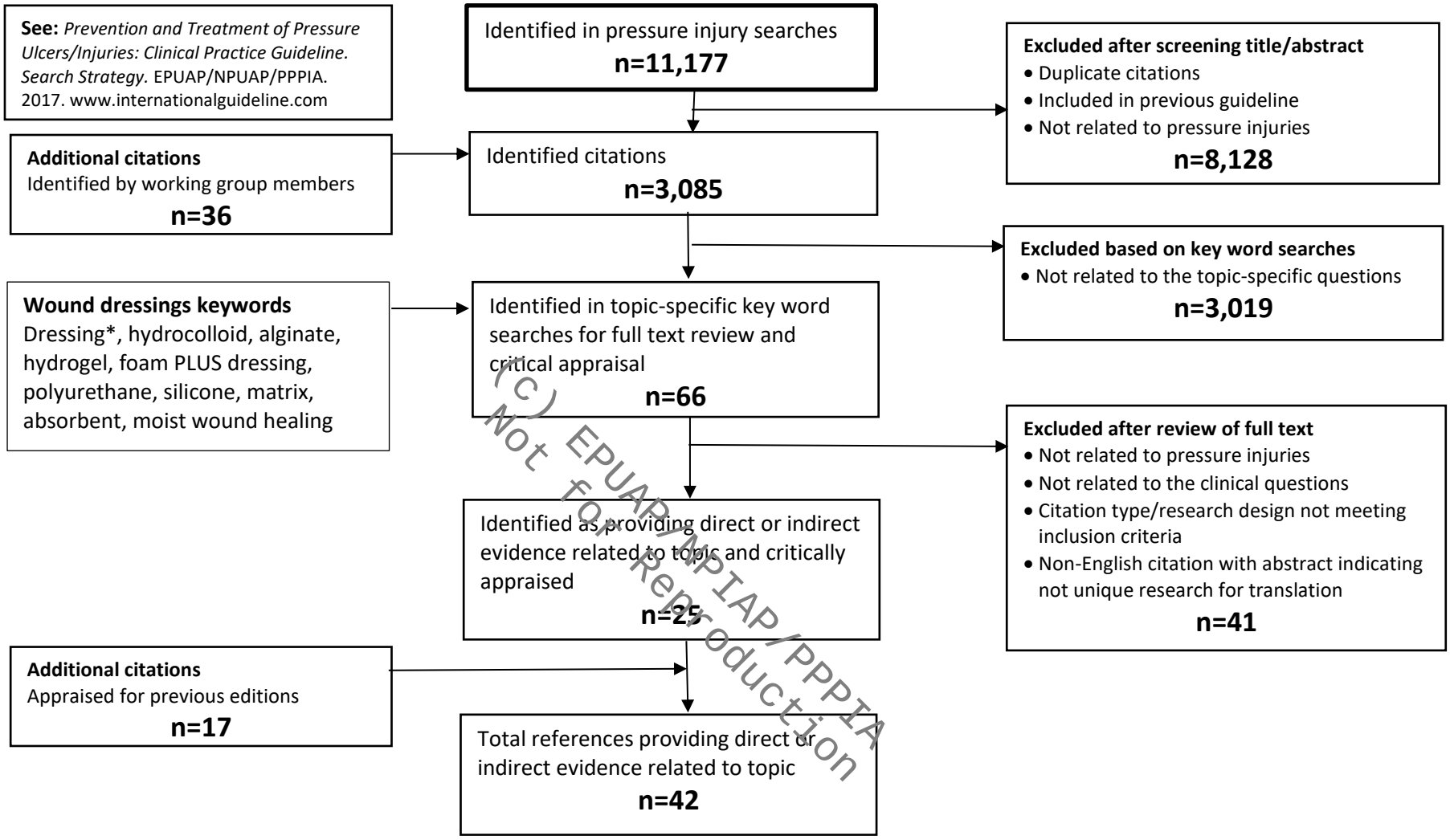
Wound Dressings for Pressure Injuries: data extraction and appraisals

Search results for 2019 International Pressure Injury Guideline: Wound Dressings



European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA; 2019

Articles Reviewed for International Pressure Injury Guideline

The research has been reviewed across three editions of the guideline. The terms pressure ulcer and pressure injury are used interchangeably in this document and abbreviated to PU/PI. Tables have not been professionally edited. Tables include papers with relevant direct and indirect evidence that were considered for inclusion in the guideline. The tables are provided as a background resources and are not for reproduction.

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Ref	Type of Study	Sample	Intervention(s)	Outcome Measures & Length of Follow-up	Results	Limitations and comments	
Clinical question 1: What wound dressings are effective for supporting healing of partial thickness pressure injuries?							
Brown-Etris et al., 2008	Prospective RCT comparing absorbent acrylic **dressing to hydrocolloid dressing for Category/Stage II and shallow Category/Stage III pressure injuries**	Participants recruited from aged care homes, wound care clinics and home care agencies in US (n=72 recruited Inclusion criteria: • Aged more than 18 years • Category/Stage II and shallow stage III pressure injuries • Minimal to moderate exudate Exclusion criteria: • Skin diseases • Diabetes mellitus with uncontrolled blood sugar • Steroids, immunosuppressants • Hypersensitivity to dressings • Pressure injury with >50% necrosis, >1cm undermining or tunnelling, or requiring filling • Requiring dressing to be cut to a smaller size • Clinical infection Participant characteristics:	• Participants were randomized to receive either ○ Transparent absorbent acrylic dressing (Tegaderm® absorbent Clear Acrylic Dressing, n=35) or ○ Hydrocolloid dressing (n=37) • Dressings performed weekly • Dressing size was optimally matched to the needs of the wound	• Dressing performance assessments and patient comfort were rated on 5 point scales from poor to very good • Dressing wear time was observed. • Wound healing was defined as closer of the epidermis. • Patients were followed for up for a maximum of 56 days or until their ulcer healed. • Wound assessment weekly	**Wound healing** • There was no significant difference in wound total wound closure 59.5% vs 60%,p=0.963). • There was no significant difference in cm/week healing (0.12±0.136cm/week vs 0.10±0.205cm/week, p=0.6520) • Peri-wound maceration did not differ significantly between groups (p=0.27) **Clinician assessment** Acrylic dressing ranked superior: • ability to center dressings over the ulcer (p=0.005), • ability to assess the ulcer before (p<0.001) and after application (p<.001) • barrier properties (p=0.039) • conformability before (*p*=0.026) and after application (p=0.001) • ease of removal (*p*<0.001) • residue in the wound (p=0.002) or on peri-wound skin (p<0.001) • odor after absorption(p=0.016)	• Randomization and allocation concealment methods not reported • No blinding • Non-standard wound assessment tools used • Comorbidities and concurrent management strategies not reported • No power analysis	**Level of evidence: 1** **Quality: Low**

		• 60% had Category/Stage II pressure injuries			**Patient assessments** Acrylic dressing ranked as superior: • comfort during removal (p<0.001) • overall comfort (p<0.001) **Duration of dressing wear time** Mean (SD) wear time for the absorbent acrylic dressing was longer but not significantly different to the hydrocolloid dressing (5.7±2.55 days versus 4.7±2.29, p=0.086) **Adverse events** No adverse events deemed associated with treatment **Conclusions: Transparent absorbent acrylic dressing has favored performance over the hydrocolloid dressing as standard treatment for shallow pressure injuries.**		
Carr & Lalagos, 1990	Observational study **evaluating polymeric membrane dressing for primarily Category/ Stage I and II pressure injuries**	Participants were recruited at two aged care facilities in US via unknown methods (n=13 participants with n=18 pressure injuries) Inclusion criteria: Category/Stage I, II or III pressure injuries Participant characteristics: • Primarily Category 1 (17%) and Category/Stage II (50%) pressure injuries • Mean pressure injury duration at entry was 144 days (range 1 to 700 days) • Large range of comorbidities • Pressure injuries had previously been treated with povidone-iodine, acetic acid	• All pressure injuries treated with polymeric membrane dressing made with absorbent pad and film coat described as being able to wick and absorb • Dressing changed as necessary • Participants received nutritional interventions that are not reported	• Wound photography • Interviews • Wound measurements (method not reported)	**Wound healing** • No report on change in wound size • 67% of Category/Stage I pressure injuries resolved in between 5 and 19 days • 67% of Category/Stage II pressure injuries resolved in between 8 and 61 days • 50% of Category/Stage III pressure injuries resolved in between 39 and 84 days	• Selection and recruitment strategies not reported • Method of evaluation is not clearly reported • No blinding, no comparison group • Participants entered into study more than once if they had multiple pressure injuries • Does not report concurrent management	**Level of evidence: 4** **Quality: Low**

		wet to dry, hydrocolloid and transparent film dressings					
Graumlich et al., 2003	RCT comparing **collagen dressing to a hydrocolloid dressing for primarily Category/ Stage II pressure injuries**	Participants were recruited from 11 nursing homes in the US (n=65 recruited, n=65 analyzed) Inclusion criteria: Aged above 18 years Stage 3 or 3 pressure injury Exclusion criteria: Allergy to products Osteomyelitis, cellulitis, malnutrition Eschar or necrosis of pressure injury Participant characteristics: • Mean age approx. 80 years • Mean duration of pressure injury 3 to 6.5 weeks • Mean Braden score around 12 • About 80% had stage 2 pressure injury and 20% with stage 3	• All pressure injuries received • Participants were randomized to receive: ○ Collagen dressing: sterile saline applied, collagen sprinkled in thin continuous layer over wound bed, gauze applied (n=35), or ○ Hydrocolloid (n=35) • Treatment for 8 weeks or to complete healing (whichever first) • Stratification by diagnosis of diabetes	• Digital photography, length, width, depth • Outcomes measured by blinded clinical nurses • Cost analysis	**Wound healing outcomes at 8 weeks** • Collagen dressing was as effective as a hydrocolloid dressing in achieving complete wound healing (50% vs 51%, mean difference 1%, 95% CI –26 to 29%, p=0.893) • Collagen dressing was as effective as a hydrocolloid dressing when measured by mm^2/day (6±16 vs 6±19, mean difference 0, 95% CI –9 to 8, p=0.942) • No adverse events were experienced • Adjustment for category/stage of pressure injury showed no significant difference between interventions **Cost analysis** • Considering dressing materials, ancillary supplies and labor costs, collagen dressing was more expensive that hydrocolloid dressing for 8 weeks (average per patient cost hydrocolloid $222 versus collagen $627) ($US in 2003) • Collagen dressings required 7 nursing interventions per week versus 2 for hydrocolloid. **Author conclusions: Collagen dressing has no advantage over hydrocolloid and is more expensive to use.**	• 17% lost to followup (equivalent between groups) but used ITT analysis • Blinded outcome measurement and analysis •	**Level of evidence: 1** **Quality: high**

Yastrub, 2004	RCT comparing a **polymeric membrane dressing to antibiotic ointment and dry dressing for healing Category/ Stage II pressure injuries**	Participants were recruited in a long term care facility in US (n=50 enrolled, n=44 analyzed) Inclusion criteria: • Category/Stage II pressure injury • Aged over 65 years • Limitations in activities of daily living Exclusion criteria: None reported Participant characteristics: None reported	• Participants were randomly assigned to receive: • Polymeric membrane dressing (n=21), or • Antibiotic ointment plus a dry dressing (n=23) • All participants received nutritional supplements, vitamin C and zinc sulfatepolymeric • All participants received pressure relieving mattress, foam chair cushion and 2-hourly repositioning	• Healing evaluated using PUSH on a weekly basis • Evaluations conducted by non-blinded nurses who were trained in use of NPUAP 1997 classification system • 4 week follow-up	**Wound healing evaluated as mean improvement in PUSH scores** • Participants treated with polymeric dressing had significantly better improvement scores (mean 3.238±2.32 vs 1.6087±1.61637, p<0.0001) • 87% of participants in the polymeric group showed improvements vs 15% in the comparator group **Conclusions: pressure injuries treated with polymeric membrane dressing showed better outcomes than those treated with antibiotic cream. The pressure injuries were not reported to be infected.**	• Small sample size with approx. 10% dropout that are unreported • No reporting of methods for randomization, allocation concealment • No blinding • Pressure injuries treated with antibiotics despite no diagnosis of clinical infection so the comparison treatment was inappropriate • No demographics or comorbidities reported	**Level of evidence: 1** **Quality: low**
Thomas, Goode, LaMaster, & Tennyson, 1998	RCT comparing a **hydrogel dressing (aloe vera dressing) to saline gauze for healing pressure injuries**	Participants were recruited in an aged care facility (n=41 randomized, n=30 analysed) Inclusion Criteria: • Category/Stage II-IV pressure injuries • Surface area ≥1.0 cm^2 Exclusion criteria: • Wounds of different etiology • sinus tract/undermining > 1 cm • Clinical infected wounds • Survival likely < 6 months	• Participants were randomized to receive either ○ Acemannan (aloe vera) hydrogel (Carrasyn™ Gel Wound Dressing, Carrington Laboratories, Inc.) applied daily (n=16), or ○ Normal saline gauze daily dressings (n=14) • 40% of participants in the Acemannan dressing group and 15% in the control group received pressure relieving devices (p=0.22)	• Weekly measurement of wound surface area with tracing and photograph • Data collected for 10 weeks unless healing occurred before	**Healing** • Healing rate was not significantly different between groups (acemannan group 63% vs control 64%, odds ratio [OR] 0.93, 85% CI 0.16 to 5.2, p=0.92) • 93% of Category/Stage II pressure injuries healed, but it was not clear which group that were in • 46% of Category/Stage III pressure injuries healed, but it was not clear which group that were in • 0% of Category/Stage IV pressure injuries healed	• Methods of randomization, allocation concealment not reported • No blinding • No ITT analysis, 27% dropped out of study and not analyzed • Method of assessing wound was not reported	**Level of evidence: 1** **Quality: low**

		• Drug or alcohol addict, HIV positive • Pregnant/nursing • Cancer, chemotherapy, severe generalized medical conditions Participant characteristics: • Mean age 76±12 (range 35-97) • Mean wound size 5.9 - 8.9 cm^2 • Caucasian 53%, Black 47% • Category/Stage II 47%, Category/Stage III 43%, Category/Stage IV 10%					

Viamontes, Temple, Wytall, & Walker, 2003	Retrospective chart review comparing **hydrocellular dressing to a soft-silicone dressing for healing**	Charts and MDS data of nursing home patients in Florida (n=1,891 patients included, n=3,969 pressure injuries)
		
		Inclusion criteria:
		• Wound treated with hydrocellular dressing or a soft-silicone dressing at least once
		
		Exclusion criteria:
		None reported
		
		Participant characteristics:
		• 95% of wounds included were pressure injuries of which:
		  ○ >1% Category/Stage I
		  ○ 47% Category/Stage II
		  ○ 39% Category/Stage III
		  ○ 5% Category/Stage IV
		• Mean age was 82.5 (range 29-106)
			Wounds were classified as receiving either:
			• The hydrocellular dressing (Allevyn Adhesive Dressing, Smith and Nephew) (n=3,795 pressure injuries)
			• soft-silicone dressing (Mepilex® Border, Mölnlycke Health Care)
			• both dressings
				• Periwound skin stripping
				• Wound closure (evaluated as yes/no)
				• Wound infection rate (defined as a wound treated with an antibiotic solution)
				• Assessment made by one nurse at the bedside
				• Unit of analysis was the wound
				• Average treatment time was 71.3 days (range 5 to 1,386)
					Wound healing
					53% of wounds treated with hydrocellular dressing and 50% treated with soft-silicone dressing healed
					
					Skin stripping
					Skin stripping occurred during dressing removal in less than 1% of wounds treated with hydrocellular dressing and 2% of wounds treated with soft-silicone
					
					Infection
					Infection was more frequent in the wounds treated with soft-silicone vs hydrocellular (3% vs9%)
						• Retrospective review relying on accurate medical records
						• Unclear if distribution of Category/Stage pressure injuries was equivalent between dressings
						• Infection was defined by the treatment applied rather than the clinical condition of the wound
							Level of evidence: 4
							
							Quality: low

		• Wounds treated with hydrocellular dressing were larger and deeper at baseline					
Kaya, Turani, & Akyüz, 2005	RCT to compare an occlusive **hydrogel dressing to iodine soaked gauze dressing for treating primarily Category/ Stage I and II pressure injuries**	Participants were people with spinal cord injury recruited in a hospital in Turkey (n=27 people with n=49 pressure injuries) Inclusion criteria: None stated Exclusion criteria: None stated Participant characteristics: • Primarily males • 100% had spinal cord injury • 25% Category/Stage I pressure injuries, 69% Category/Stage II pressure injury, 6% Category/Stage III pressure injury • Baseline age, Hgb, Albumin, TLC, ulcer size and grade were not statistically significant different between groups	• Participants were randomized to receive either: ○ Hydrogel dressing (Elasto-Gel™, Southwest Technologies, n=15 people with n=25 pressure injuries), or ○ Povidone –iodine soaked gauze (n=12 people with n=24 pressure injuries) • All wounds from the same participant received the same treatments and were analyzed individually	• Rate of healing (cm^2 of surface area/day) measured every 4 days by unreported methods until complete epithelialization • Treatment time • NPUAP classification system • Healing time was computed at discharge in non-healed wounds by subtracted by current size of the ulcer from the baseline	**Complete healing** Significantly more wounds healed in the hydrogel group compared with the control group (84% vs 54.2%, p=0.04). **Mean healing rate** • Mean healing rate was not significantly different between hydrogel dressing group ($0.12cm^2$/day±0.16) and povidone-iodine gauze group ($0.09±0.05cm^2$/day, p=0.97) • Time to healing was not significantly difference (p=0.06) **Treatment time** Mean treatment time was not significantly different between hydrogel dressing group (51.56 days±20.07) and povidone-iodine gauze group (51.54 days±23.69, p=0.70)	• Statistical errors in study • Does not report methods of randomization or allocation concealment • Unit of analysis is the pressure injury rather than the individual • Does not report methods for evaluating wounds or if a valid and reliable method was used • Appears to be non-blinded	**Level of evidence: 1** **Quality: low**
Meaume et al., 2003	Exploring **soft-silicone foam dressing for treating Category/ Stage II pressure injuries**	Participants were recruited from aged care facilities in a range of European countries (n=38) Inclusion criteria: • Aged ≥65 years • Category/Stage II pressure injury • Modified Norton scale score ≥11	• Participants were randomized to receive either: ○ soft silicone polyurethane foam dressing (Mepilex® Border, Mölnlycke Health Care, n=18), or ○ Hydropolymer polyurethane foam dressing (Tielle™, Johnson and Johnson, n=20) ○ Hydrating gel (Normlgel®, Mölnlycke Health Care) used as required	EPUAP Classification system Wound size using wound tracings Tissue type (percent granulation tissue using categories) Exudate (low, moderate or high) Signs of inflammation (Yes/No)	**Wound healing and condition outcomes** • There was no significant difference in healing rates at 8 weeks between soft silicone dressing group and hydropolymer dressing group (44% versus 50 %). • No differences in the signs of inflammation, amount of exudate, odor, exudate or leakage were observed.	• Very small sample size • Non-blinded evaluations of wounds and dressing performance • Unlikely to be adequately powered to measure change	**Level of evidence: 1** **Quality: moderate**

		• Red/Yellow wound according to Red/Yellow/Black system Exclusion criteria: • Underlying disease that might interfere with treatment • Hypersensitivity Participant characteristics: • 100% Caucasians • Sacral and heel pressure injuries were more frequent	• Dressings attended weekly or as needed • Participants were managed with pressure relieving mattresses and 2 hourly repositioning	Maceration and other tissue damage (Yes/No) Odor (Yes/No) Ease of use and number of dressings Adverse events The same clinicians performed the evaluation for individual wounds throughout the study	• Tissue damage (edge, bed or surrounding skin) was higher in the hydropolymer group (23 reports vs 2 reports) **Adverse events** • Adverse events classified as related to treatment were higher in the hydopolmer group (3 events) vs the soft silicone group (1 event) but significance was not tested. • Adverse events included hypergranulation, surrounding skin trauma and redness/irritation) **Author conclusions: soft-silicone dressing has equivalent performance in wound healing as hydropolymer dressing but has less damage to skin.**	and no statistical results reported	
Clinical question 2: What wound dressings are effective for supporting healing of full thickness pressure injuries?							
Hao, Feng, Chu, Chen, & Li, 2015	Quasi experiment investigating **effectiveness of hydrocolloid dressings and ceramide dressings**	Participants (n=72 plus n=25 control) were recruited in a Chinese hospital Inclusion criteria: • Aged > 60 years • Category/Stage II to IV PU • Unable to independently reposition Exclusion criteria: • Non-consenting or discharged in the middle of study Participant characteristics: • Appear to all be trochanter pressure injuries, but not clearly stated	• All participants were divided into 3 groups: ○ Group a) ordinary hydrocolloid dressings made of polyurethane film and 0.40mm thick with a low friction nylon outer layer (n=24) ○ Group b) ceramide dressing made of polyurethane foam and 0.40mm thick with a low friction nylon outer layer (n=24) ○ Group c) hydrocolloid dressing and ceramide dressing (n=24) • A fourth group of participants with SCI and risk of PU (bit no existing PU) were a control group (n=25) who received normal hydrocolloid dressing.	• Outcome measures recorded at baseline and every 10 days when dressings changed. Patients were placed supine for 30 minutes before measures taken. • Outcome measures: ○ Skin pH ○ Skin hydration measured by capacitive method ○ Erythema	**Erythema** • Group a) (Category/Stage III and IV pressure injuries treated with ordinary hydrocolloid dressings) had significantly more erythema (16.67% vs 4.17% in other groups) than the other two groups • Control group had significantly more erythema than Group a) **Study conclusion: Ceramide dressings were more effective in reducing erythema than hydrocolloid dressings, however there were different severity of pressure injuries in the groups**	• No measure of healing was made • Groups not equivalent at baseline with respect to severity of PU • Unclear how erythema was measured and whether investigators were blinded • Control group had no wounds	**Level of evidence: 2** **Quality: low**

		• Group a) had Grade III and IV pressure injuries • Group b) had only Grade II pressure injuries • Group c) had only Grade III pressure injuries • No erythema present at baseline	• All dressings changed every 10 days • All participants repositioned 4 hourly				
Linthwaite & Bethell, 2016	Case series evaluating of new hydrocolloid technology in pressure ulcers and moisture lesions	Participants were recruited in two hospitals in UK (n=10) Inclusion criteria: • Pressure injury Category/Stage II or III pressure injuries or moisture lesions Exclusion criteria: • Not mentioned Participant characteristics: • 90% sacral pressure injuries • Duration of wounds was < 2 weeks for 80% of pressure injuries • No comorbidities existed for 50% of participants	• Application of one of two hydrocolloid dressings ○ Participants with Category/Stage II pressure injuries and moisture lesions received BeneHold® TASA® (Aspen Medical) hydrocolloid dressing (n=5) ○ Participants with Category/Stage II or III pressure injuries received BeneHold Bordered hydrocolloid dressing • Transparent dressing means dressing does not need to be removed daily (n=5)	• Evaluation performed over 3 months • Evaluation form not tested for reliability or validity • Classification system not defined. • Pain level using numerical scale (0-10) • Clinician satisfaction • Ease of application and removal.	**Dressing wear time** For 100% participants, dressing wear time was extended (for 50% of participants this was more than 7 days wear time, not documented for other 50%) **Wound healing** There were only 6 of 10 wounds reported. Among of 6 wounds, 4 reported heal. **Performance rating** • Application and removal (100% reported very easy). • Pain (80% reported no pain). • Performance (100% evaluator reported very good) **Author conclusions: The use of hydrocolloid technology decreases healing times, minimizes pain on removal, reduced dressing changes and brought cost savings**	• Small sample size. • Missing data (demographic, risk and wound status, outcome reporting) • Objectives was evaluated qualitatively. • Wound dimensions were not recorded • Performance rating reported subjectively. • Presence of conflict of interest • No formal cost evaluation performed	**Level of evidence: 4** **Quality: low**
Souliotis, Kalemikerakis, Saridi, Papageorgiou, & Kalokerinou, 2016	RCT evaluating **cost and clinical effectiveness analysis between**	• Participants were recruited from homecare in Greece (n=100) Inclusion criteria:	• Participants were randomized to receive either: ○ moist wound healing dressings, including foam dressings, silver foam dressing, silver sulfadiazine dressing, ibuprofen-releasing foam	• Total product cost until wound healing, daily wages & cost of healthcare persons per home visit, cost of other materials including gloves,	**Average wound healing time** Moist wound healing dressing group had significantly faster wound healing times compared to control group (85.56±52.09 days vs 121.4±52.21 days, p = 0.0001)	• Did not include travel costs to patient • Medium-sized pressure injuries were selected, but larger	**Level of evidence: 1** **Quality: Moderate**

	moist wound healing dressings and gauze in a homecare setting for Category/Stage III and IV pressure injuries	• Category/Stage III or IV pressure injury requiring a wound dressing Exclusion criteria: • Age <18, • end stage chronic heart disease, dependent diabetes, cancer, serious immunodeficiency, severe systematic infection, • previous pressure injury treatment with a different method Participant characteristics: • Mean age 75 to 77 years • Mean surface area from 41.5cm^2 to 43.5cm^2 • Primarily located on coccyx or trochanter	dressings (n=50 randomized, n=47 analyzed), or ○ Plain gauze dressing (n=50 randomized, n=48 analyzed) • All pressure injuries cleansed with normal saline and if signs of colonization or infection povidone or other antiseptic solutions were used	saline, syringes, antiseptics, and adhesive tapes • Ulcer size measurement with sterile transparent graded films • Data collection and ulcer measurements was done once a month until complete healing	**Dressing change frequency** Moist wound healing dressing group had significantly fewer wound dressing changes compared to control group (49.5±29.61 vs 222.6±101.86, p<0.0001) **Total treatment cost** Average treatment cost per patient until healing achieved was lower for the moist wound healing dressings compared with control (€1,351 vs €3,888)	pressure injuries have higher treatment costs and healing duration • The faster healing among moist wound healing dressings could relate to using topical antimicrobials • Wide range of products used so it is difficult to determine if any specific contemporary dressing is superior	
Ausili et al., 2013	An uncontrolled observational study evaluating **the effectiveness of calcium alginate and foam dressings in treatment of Category/Stage III and IV pressure injuries.**	Participants were recruited in aSpina Bifida Center in Italy (n=14) Inclusion criteria: • Spina Bifida patients Category/Stage III and Stage IV pressure injuries Exclusion criteria: • Category/Stage I and stage II pressure injury Participant characteristics: • 50% males • Mean age 17.21 years±5.6 years (range 12 to 24) • Mean BMI 23/8kg/m^2 • Primarily wheelchair users	• Application of calcium alginate dressing applied every second day for 4-6 weeks, thereafter, foam dressing were applied every three days	• Initial evaluation at start of care and monthly thereafter • Wound surface area • Planimetry, wound tracing and photography • Pressure injury staging using EPUAP classification • Dressing tolerance, measurement was not reported	**Reduction in mean absolute wound area in cm^2** After 12 weeks the mean surface area was significantly less than at baseline (3.7±5.2cm^2 versus12.5±7.5cm^2, p<0.001) **Percentage of pressure injuries with a reduction mean surface area by 50% or more** 4 weeks: 40% of participants 8 weeks 60% of participants Trial End (12 weeks) 75% of participants **Dressing tolerance** Reported as good but method of measurement and data are not reported	• Small study with no control group and no blinding • Wound measurement outcomes were only measured on a monthly basis • Selection and recruitment is poorly reported • Sample has a very low mean age, not representative of most people with a pressure injury	**Level of evidence: 4** **Quality: low**

		• Pressure injuries were located on heel, sacrum. Foot in equal distribution			**No adverse events occurred** **Author conclusion: Treatment of Category/Stage pressure injuries with calcium alginate and foam dressing are safe and valid for people with reduced mobility and with Category/Stage III and IV pressure injuries**	• Hard to evaluate any single dressing product • Two participants who dropped out were not analyzed • Confounders (e.g. comorbidities, pressure injury management) not reported	
A. Chuangsuwanich, Chortrakarnkij, & Kangwanpoom, 2013	RCT comparing alginate silver dressing (AISD) and silver zinc sulfadiazine cream (SSD) in terms of cost-effectiveness in treatment of pressure ulcers.	Participants recruited from outpatient department of university hospital based in Thailand (n=22 randomized, n=20 analyzed) Inclusion criteria: • Category/Stage III or IV sacral or trochanteric pressure injuries • Aged > 20 • Informed consent • Attend weekly follow-up Exclusion criteria: • Pressure injuries needing extensive debridement • Infected pressure injuries • Hypersensitivity to products • Glucose-6-phosphate dehydrogenase deficiency Participant characteristics: • Mean age between 73 and 76 years • Primarily sacral pressure injuries	All wounds debrided as necessary Participants were randomly assigned to receive either: AISD (Askina® Calgitrol® Ag, B. Braun Hospicare Ltd.) applied to wound every 3 days (n=11 randomized, n=10 analyzed), or SSD cream and dry gauze applied to wound daily (n=11 randomized, n=10 analyzed)	• Weekly assessment of wounds by nurse and independent plastic surgeon for 8 weeks • Wound size measured by Visitrak and photography • Pressure injury characteristics and healing rate assessed using PUSH score • Treatment cost estimated from products used	**Percent wound area reduction over 8 weeks** There was no significant difference in reduction in wound area between ASID and SSD cream (44.27% vs. 51.07%, p=0.504) Both groups showed improvements but whether results were significant not reported **PUSH scores over 8 weeks** There was no significant difference in reduction in PUSH score between ASID and SSD cream (p= 0.402) Both groups showed improvements but whether results were significant not reported **Exudate management (as score on PUSH)** There was no significant difference in between ASID and SSD cream in reduction in exudate (p=0.557) Both groups showed improvements but whether results were significant not reported	• Method of randomization and allocation concealment not reported • No blinding • No comparison between standard care or control. • Variation in treatment applications which would bias treatment cost estimates. • Power calculation based on 2 point change in PUSH score • Participants who were randomized not complete the study were excluded from	**Level of evidence: 1** **Quality: Low**

		Similar comorbidities between groups including diabetes, cerebrovascular accidents, dyslipidemia			**Authors Conclusion: AISD can be used for Category/Stage III and IV pressure injuries with a better wound healing profile than conventional treatment.**	analysis (about 10%/group)	
Li, Yao, Wang, & Zhao, 2016	RCT examining **effects of gelatin sponge combined with moist wound healing** in treatment of Category/Stage III pressure injury	Participants with breast cancer were recruited in one hospital in China in a 9 month period (n=50) 50 breast cancer patients with phase III bedsore Inclusion criteria: Category/Stage III pressure injury Exclusion criteria: Not indicated Participant characteristics: Age, wound location and Braden score were not statically significant.	• Participants were randomized to receive either: ○ Gelatin sponge dressing group: saline cleansing, sharp debridement, gelatin sponge changed 1 to 2 days until healthy granulating tissue present, then changed weekly. For infected wounds, gelatin sponge was soaked in silver ion alginate (n=25), or ○ Conventional care including hydrogen peroxide or iodine, debridement, ethacridine gauze pack, dressing change every 1-2 days (n=25) Other management also differed: • Experimental group received 2 hourly repositioning, bed at 30° to prevent high sacral pressure, air cushion bed, health education and optimized nutritional status. Control group received standard care	• Pressure Ulcer Scale for Healing (PUSH) • Wound healing evaluated as excellent (totally healed), effective (no significant abnormality, PUSH score decreased), ineffective (no change in PUSH score), deteriorated (PUSH score decreased) • Braden scores • Wound surface area in cm^2 • Frequency and time of dressing change • Cost • NPUAP pressure ulcer staging system • Follow up period: 28 days	**Wound healing** • Sponge group had significantly more pressure injuries categorized as excellent or effective compared to control group (92% vs 68%, p=0.034) • Sponge group showed significant reduction in pressure injury area (cm^2) compared to control group (p=0.025) **Braden score** Significantly more participants in gelatin group had reduction in Braden score compared to baseline observation group than in the control group (p=0.032) **Frequency and time of dressing change** Frequency of dressing change lower in gelatin group compared to control group (7.8±0.9 vs 6.2±2.7, p=0.039) Time taken to attend dressing significantly lower in gelatin group compared to control group (20.9±8.4 vs 31.8±12.6, p=0.037) **Cost** Average costs of hospitalization were significantly lower in the gelatin sponge group compared with control group (p<0.001)	• Potential confounders (e.g. comorbidities and nutritional status) not reported • Unclear who performed wound assessments • Method of randomization and allocation concealment not reported • No blinding • Small sample • Other management strategies varied and the wound dressing cannot be considered the only different treatment between groups •	**Level of evidence: 1** **Quality: Low**

					Author conclusion: that gelatin sponge promote moist wound – healing which can improve the healing Category/Stage III pressure injuries		
Takahashi et al., 2017	RCT comparing **effectiveness of plastic wrap dressing with standard treatments in management of Category/Stage III and IV pressure injuries**	• Participants were recruited from 10 geriatric/psychiatric and 2 care facilities in Japan (n=142 participants) Inclusion criteria: • Aged 20 years or older • Category/Stage III or IV pressure injury measuring 4cm² to 80cm² and at least 50% of the surface area covered by necrotic tissue Exclusion criteria: • skin ulcer due to other etiology • Uncontrolled diabetes • corticosteroids, immunosuppressant cytotoxic agents or radiotherapy • Healing pressure injuries • HbA1c > 10% Participant characteristic: • Participants had dementia, cognitive delay or schizophrenia • Standard care group had significantly lower PSST score at baseline (P=0.009) • Plastic wrap group had significantly lower hemoglobin at baseline (p=0.03)	• Participants were randomized to receive either: ○ Plastic wrap dressing: Wound dressed with non-sterile plastic wrap according to wound size, and secured with a non-woven tape with weak adhesive power to allow excess exudate to drain, no packing for deep wounds, and dressings changed twice daily or 3-4 times for infected wounds (n=74 randomized, n=71 analyzed), or ○ Control group: Colloid, hydrocellular polyurethane, alginate and transparent film dressing were used on wounds with minimal exudate and changed 2-3 times per week. Ointments and gauze dressing for deep cavities wound with high exudate and changed 2 or more times a day (n=68 randomized, n=65 analyzed). • All participants received standard treatment procedure such as systemic antibiotic and surgical debridement for wound infection, prevention and management protocols to improve moisture of skin, activities, and nutrition as well as pressure redistribution support surfaces	• Absolute wound Surface Area Reduction (baseline surface area – actual surface area) measured by digital camera imaging by the same investigator • Change in pressure ulcer status using the Pressure Sore Status Tool (PSST) by non-blinded assessors • International Pressure Ulcer Staging Guideline 2014 • 4, 8, 12 weeks	**Mean reduction in wound surface area** Plastic wrap dressing group showed significantly greater surface area reduction than the standard dressing treatment at 4 weeks (7.4±7.1 vs 4.7±4.8, p=0.0103), at 8 weeks (10.0±9.3 vs 5.8±5.9, p=0.002), and at 12 weeks (11.1±9.9 vs 6.7±7.1, p=0.0032) **Mean reduction in PSST score** Plastic wrap group had better PPSST scores at 4 weeks (p=0.0076), 8 weeks (p=0.0123) and at 12 weeks (p=0.0065) than in the standard treatment group **Other outcomes** • Periwound maceration was not significantly different (plastic wrap 9.9% vs control 3.1%, p=0.01689) • Infection rate was not significantly different (plastic wrap 5.6% vs control 7.7%, p=0.7366) **Conclusion: Plastic wrap dressing treatment is more effective than standard treatment for Category/Stage III or IV pressure ulcers in the inflammatory phase.**	• Methods of randomization not reported • Not double blinded • There is ethical and safety concern of the plastic wrap treatment as it is not a medical grade • Small sample size • Insufficient statistical	**Level of evidence: 1** **Quality: Low**

		• Most pressure injuries were sacral or heel					
Sayag, Meaume, & Bohbot, 1996	RCT comparing alginate dressing to dextranomer paster for healing Category/Stage 3 or 4 pressure injuries	Participants were recruited in 20 dermatology or gerontology specialist centers (n=92) Inclusion: • Aged >60 years • Hospitalized > 8 weeks • Category/Stage III or IV pressure injury • Surface area 5 to 100cm^2 Exclusion criteria: • >half the surface area granulated • Necrotic plaque or active infection • Renal failure • End-stage arteriopathy • Radiotherapy/chemotherapy Participant characteristics: • No significant difference • Mean age around 80-81 years • Heel or pelvis pressure injuries • Mean duration 3 to 2.5 months • Primarily Category/Stage III pressure injuries (about 70%)	• Participants received either calcium alginate (Algosteril®, Smith and Nephew) (n=47) or 3mm thick dextranomer paste (Debrisan®, Pharmacia AB)(n=45) • Dressing changed daily to 4 daily	• Photography • Planimetry evaluation • Treatment continued until 40% reduction in wound area, or 8 weeks	**Pressure injury healing** 13% in dextranomer group and 32% in alginate group almost healed At least 40% reduction in surface area in 74% alginate group and 42% dextranomer group (p=0.002) Mean surface area reduction/week was significantly greater in the alginate group than the dextranomer paste group (2.39±3.54cm^2/week vs 0.27±3.21cm^2/week,p=0.0001)	• Outcome measure was 40% reduction in size • 21% alginate group and 49% dextranomer group dropped out	**Level of evidence: 1** **Quality: Moderate**
Belmin, Meaume, Rabus, Bohbot, & The Investigators of the Sequential	RCT **to compare sequential treatment with calcium alginate and hydrocolloid dressings**	Multiple-center (n=110) Inclusion criteria: • noninfected • granulating • Category/Stage III or IV	• Participants received calcium alginate or hydrocolloid dressings	• Wound surface area	Healing rate was more rapid in the pressure ulcers treated with calcium alginate first, compared to the group treated with hydrocolloid dressings alone: Reduction in mean surface area 69.1% versus 42.6%, mean difference 26.5, 95% CI 10.62 to 42.38)	•	**Level of evidence: 1** **Quality: Low**

Treatment of the Elderly with Pressure Sores, 2002		• Mean surface area around 16 to 20 cm^2			**Author conclusion: Alginate-hydrocolloid is associated with greater reduction in mean percentage wound area than plain hydrocolloid**		
Takahashi et al., 2006	Prospective, open label, non-randomized controlled trial of food wrap (a semi occlusive dressing) for managing Category/ Stage III and IV pressure injuries	Participants were recruited in two geriatric wards in Japan (n=53 recruited, 49 analyzed) Inclusion criteria: • Category/Stage III or IV pressure injury • yellow, highly exuding pressure injury • Braden scale <17 Exclusion criteria: • Braden scale ≥17 • Increased activity or marked improvement in ability to perform ADLs (e.g. rise in activity score on Braden scale from 1-2 to 3-4) • Red proliferation phase Participant characteristics: • At baseline, the groups were the same for gender, age, mental disorders, Braden score, stage of PrU, surface area, location, state of ulcer (with cellulitis or undermining) or systemic disease • Primarily Category/Stage IV pressure injuries with about 40% exhibiting undermining	• Participants received either: ○ Plastic wrap group: Wound dressed with non-sterile plastic wrap according to wound size, and secured with tape, no packing for deep wounds, and dressings changed at least daily (n=27 assigned, n=25 analyzed), or ○ Control group: saline cleanse, dry gauze and iodine-sugar, iodine-cadexomer paste, antibiotic agents (SSD cream) or enzymes. Gauze packing used as required. When wound improved, topical management changed to alprostadil alfadex, tocoretinate or bucladesine. • All participants received pressure relieving mattresses and chair cushions • If infection developed, wound was debrided	• DESIGN, a tool designed in Japan was used to measure depth, exudate, size, infection, granulation, necrosis + pocket undermining. Total score ranges from 0-29, tool has strong psychometric properties • Incidence of adverse events including local wound infection that developed into cellulitis, maceration, and development of eschar • DESIGN was used at baseline and every 4 weeks for 12 weeks	**Wound healing** • By week 12, the experimental group had statistically significant improvement in median DESIGN tool score (median score 11 versus 7, p<0.05) • Complete healing was seen in 5 (20%) of experimental and 2 (8%) of control. **Adverse outcomes** • Systemic infection independent of the wound occurred was higher but not significantly different in the plastic wrap group (32%) versus 25%, p=0.754) • Eschar occurred significantly more often in the control group (25% vs 0%, p=0.01) • Requirement for surgery was higher in the control group (50% vs 20%, p=0.039) • Wound infection and maceration did not differ significantly between groups • **Author conclusion: Plastic wrap dressing treatment is more effective than standard treatment for Category/Stage III or IV pressure ulcers in the inflammatory phase.**	• <10% had no evaluation at 4 weeks so were excluded from ITT analysis • The experimental dressing relied on autolytic debridement which immune-compromised patients may not have • There is ethical and safety concern of the plastic wrap treatment as it is not a medical grade	**Level of evidence: 2** **Quality: Low**

Matzen, Peschardt, & Alsbjorn, 1999	RCT comparing an amorphous hydrogel v wet saline gauze for treating Category/Stage III and IV pressure injuries	Participants were recruited consecutively in Denmark from home environments k (n=32) Inclusion criteria: • Sacrum or trochanter Category/Stage III or IV pressure injury that was not infected Exclusion criteria: • Disease or drugs that can impair healing Participant characteristics: • Mean age 82-84 years (range 32-97)	• Participants were randomized to receive either: ○ Hydrogel (unstated product by Coloplast, n=17) or ○ Wet saline gauze compress (n= 15) • All secondary dressing were Comfeel® Transparent Dressing (Coloplast) • Daily dressing with debridement as necessary	• Wound volume measured weekly by filling wound cavity with water • Pain (1-4 scale) • Comfort during use (1-4 scale) • Smell (1-4 scale) • Need for debridement (measured as % of dressing attendances) • 12 week follow up or until healing	**Need for debridement** The saline control group more often needed weekly debridement compared to hydrogel group (21% versus 7%, p<0.03) **Wound healing in last week of treatment** Relative mean volume of pressure injuries treated with hydrogel was significantly less than the saline group (26±20% versus 64±16%, p<0.02) Other outcomes • There were no differences in median pain scores (2 for both groups) or odor scores (2 for both groups) • Hydrogel was rated slightly better for comfort (4 vs 3) **Author conclusions: Amorphous hydrocolloid can reduce healing times compared with saline.**	• Small sample size • Does not report methods of randomization or allocation concealment • Unclear if there was blinded outcome measurement • Unclear when pain was measured • Unclear if groups were equivalent at baseline and received similar concurrent treatment • 62.5% withdrawal	**Level of evidence: 1** **Quality: Low**
Mizokami, Murasawa, Furuta, & Isogai, 2012	Retrospective **observational study comparing iodoform gauze to povidone-iodine and sugar or sulfadiazine cream** (only data from clinical study is summarised)	Retrospective records analysis of participants with pressure injuries treated at geriatric centre in Japan between 2008 and 2010 (n=53 participants with 60 PUs) Inclusion criteria: • All participants with pressure injuries were recorded during a 2-year period and included in the study Characteristics: • Mean age approx. 80 yrs • Participants treated with iodoform gauze had	There was no indication as to how treatment was selected for each participant. Participants were treated with either: • iodoform gauze was applied with a polyurethane top dressing • The conventional treatment used as a comparison was either silver sulfadiazine cream or povidone-iodine and sugar	• Primary outcome was wound-cleaning capacity determined by the % of wound surface area covered in necrotic tissue. • The area of necrotic tissue was blindly determined using digitalized images.	**Duration of treatment required** Treatment period was significantly shorter for participants who were treated with iodoform gauze (14.1±9.7 versus 29.0±24.5, p=0.002) **Clinical condition of wound** • There were significantly greater pressure injuries treated with iodoform gauze classified as having necrotic tissue completely removed after 2 weeks of treatment compared to conventional treatments (60% versus 10%, p<0.001) • By 4 weeks, 80% of PUs treated with iodoform gauze had necrotic	• Indirect evidence: no relationship between debridement and wound healing outcomes was presented • No randomization, pre-defined outcome measures or clear participant selection	**Level of evidence: 4** **Quality: Low**

		significantly lower albumin (2.8±0.5g/dL versus 3.2±0.6 g/dL, p<0.007) • Participants treated with iodoform gauze had significantly larger wound surface area (17.6±19.6cm^2 versus 7.7±8.2cm^2, p=0.004) • Participants treated with iodoform gauze had more Category/Stage IV pressure injuries (83.3% versus 57%, p=0.009)			tissue completed removed (versus 30%, p<0.001) **Study conclusion: Iodoform gauze is effective in preparing the PU wound bed for healing, but there is no evidence from this study that this leads to complete healing or faster healing**	• Non-equivalent participants at baseline • Various comparison treatments • Concurrent management strategies not reported	
Parish, Dryjski, & Cadden, 2008	Prospective non-comparative observational study **investigating an ahesive gelling foam wound dressing (GFD-A) for promoting healing in primarily Category/Stage III or IV pressure injuries**	Participants were recruited from 6 US centres and 1 Canadian centre (n=23, n=16 completed 28 days) Inclusion criteria: • Stage II pressure injury ≥2 cm^2 or stage III or IV pressure injury Exclusion criteria: • Category/Stage I pressure injury • Category/Stage PU < 2cm^2 or pressure injury of size greater than 11.6cm x 15.5cm (maximum dimensions of dressing product) Characteristics: • Co-morbidities not reported • Mean age 57.6±20.8 years (range 18 to 97) • 61% sample males • Most pressure injuries were Category/Stage III or IV (61%) • Mean pressure injury • duration 1.0±1.8 years (range 0 to 8)	• All participants used appropriate pressure relieving devices • Wounds were debrided using the sharp method and cleansed at commencement of study. • All participants treated with: ○ An adhesive gelling foam wound dressing (AQUACEL® Hydrofiber) in either a ribbon or dressing size. • Concurrent skin barrier creams and securing aids/bandages varied according to clinician preference. • Dressing changes were done at least once every 7 days	• Primary outcome was safety • Secondary outcomes: ○ Exudate management assessed as excellent, good, fair or poor ○ Pain and comfort assessed using 11-point visual analog scale ○ Clinical improvement assessed as ulcer condition, appearance and depth (photography, acetate tracings and cotton bud depth) Subjects were followed until healing or up to 28 days or patient withdrawal.	**Condition of pressure injuries** • At final visit or 28 days, pressure injuries were described as: Healed (4%) Marked improvement (30%) Mild improvement (26%) No change 26% Mild deterioration 4% Marker deterioration (9%) • Between baseline and final visit there was no significant difference in mean per cent of pressure injuries described as epithelium (p=0.14) slough (p=0.089) or fibrin (p=0.145) and there was a significant decrease in mean per cent of ulcer bed with granulation (p=0.01) **Condition of periwound** 65% of participants had peri-skin described as healed, mild improvement or marked improvement; 22% had no change in surrounding skin, 13% had deteriorated condition of surrounding skin. **Acceptability**	• Small sample; high attrition rate. • >20% non-response on subjective measures of dressing performance by participants • Supported by a grant from company supplying product • The hydrofiber dressing was primarily used as a wound filler (50% of all dressing changes) although this is not its primary intended use.	**Level of evidence: 4** **Quality: low**

		• Mean pressure injury • size 10.6±16.4cm2 (range 0.8 to 62.5) • Mean pressure injury • depth 5.7±8.8mm (range 0 to 40) • 305 sacral, 22% heel, 4% ischial, 4%trochanter, 39% other location • Exudate: 52% moderate, 39% minimal, 9% heavy • 9% clinically infected			The dressing was described as comfortable (80% participants), soothing (64%) and cushioning (70%) **Adverse events** 30% (n=7) participants experienced adverse events related to dressing including clinical infection (n=1), wound enlargement (n=1), erythema (n=1), dressing-related maceration (n=3) and blister (n=1)		
Kerihuel, 2010	Open-label RCT **comparing activated charcoal dressing without silver with hydrocolloid dressing for managing chronic pressure injuries**	Participants were recruited from 6 hospitals and outpatient departments in N = 120 (60 in each study) Inclusion: • Pressure injury area from 5 to 100cm^2 • Pressure injury <3 months duration • Pressure injury grade II to IV on Yarkoni classification scale (i.e. full thickness but not extending to bone) • considered by assessors to have ≥50% necrotic/slough wound surface area Exclusion: • unable to consent in writing • severe illness • Pressure injury requiring surgical debridement or 100% coverage with necrotic tissue • requiring systemic antibiotics • previous use of investigation product • allergy to investigation products	• All participants received standard pressure injury prevention including repositioning and use of pressure-redistribution surfaces • All pressure injuries received sharp debridement at study commencement • Participants were randomly assigned to received either: ○ saline cleanse and activated charcoal dressing (Actisorb®) impregnated with saline, covered with gauze and secured with non-compression bandage and changed 2 to 3 times weekly (n=29) ○ Hydrocolloid dressing (Duoderm®) impregnated with saline and managed the same as the study treatment (n=30)	Wounds were assessed at weekly intervals using photography and wound tracings with follow-up was at 4 weeks Outcome measures: • reduction in wound area • relative reduction in wound area compared to baseline • percentage reduction of debrided tissue	• 23.7% participants withdrew, equivalent between groups **Wound area reduction** • Differences in reduction in mean wound surface area at week one favoured the treatment group (–2.5cm^2 versus 0, p=0.255) but were not significant. • Differences in percentage reduction in wound size compared to baseline were not significant between groups **Adverse events** More participants in the control group reported local adverse events (6.9% versus 23.3%) **Study conclusions: There was no significant difference in healing between pressure injuries treated with an activated charcoal dressing compared with a hydrocolloid dressing over 4 weeks.**	• The statistical tests used (Mann Whitney) were not appropriate to adjust for institution/ site (multivariate analysis) • No a priori power calculation, small sample size, no blinding of analysis • Products do not perform the same function in wound management so comparison is questionable	**Level of evidence: 1** **Quality: low**

		Characteristics: • Baseline patient demographic and pressure injury characteristics comparable between groups • Mean age 78.5±16.5 (control) and 83.2±13.2 (treatment) • Primarily heel injuries (66% to 76%) • 50% >1 month duration, 10 to 13% > 3 months duration • 13.3% necrotic tissue (control) and 17.2% necrotic tissue (treatment)					
Diehm & Lawall, 2005	Observational study reporting data from three studies exploring hydropolymer dressings for managing healing and wound exudate different wound types, including Category/Stage III and IV pressure injuries	Physicians selected patients for from across Germany using unreported methods over 4 years for 3 different studies (n=1793 pressure injuries) Inclusion: 4 weeks duration of wound No exclusion criteria Participant characteristics: • Mean age 74.5±13.6 • Mean wound age2 months • Wound radius 2.6 cm ±1.6 • Wound depth 38.6% deep, 9.2% had wound pouches and deep wound pouches • Infection = 47.2% • Exudate 36.7% little, 28.4% medium, 14% strong • Necrotic tissue 19.9 % none, 49.8% small, 25.6% extensive, 4.2% entire	• All pressure injuries treated with Tielle™ hydropolymer dressings • Dressings changed 3 times a week • Therapy adjusted based on severity of symptoms and course of healing •	• Data were recorded at baseline and at 4 or 12 weeks. • Estimate of exudates were scored as: 1= none, 2= little/small, 3=medium/extensive, 4=strong/entire area • Changes in wound radius and % change in wound area • Signs of infection • Level of exudate • Wound odor • Portion of necrotic tissue • Portion of fibrous adhesion • Wound status = healed, improved, unchanged aggravated •	**Wound healing at 4 weeks** (n=1181 participants reported) • Mean wound radius reduced by 67.4% • Mean wound size reduced by 77.9% • 38.9% were healed, 55.9% improved, 3.3% unchanged and 0.2% aggravated **Wound healing at 12 weeks** (n=606 participants reported) • Mean wound radius reduced by 79.1% • Mean wound size reduced by 87.5% • 57.8% were healed, 39.3% improved, 2.5% unchanged and 0.2% aggravated **Adverse events** • Withdrawals from study were 4.5% for insufficient efficacy, intolerance and worsening of the wound • 2.9% experienced pain, general intolerance and itching	• Exudate outcomes reported elsewhere in table • Combined results from these three studies that had similar objectives • No control group for comparison • Method of wound assessment may not have been consistent across studies • Large number of participants not followed for full reporting period	**Level of evidence: 4** **Quality: Low**

Davis et al., 2001	Case series study **investigating a glucose oxidase dressing**	Participants were recruited from 27 wound clinics in multiple European countries (n=100, n=13 with pressure injuries, 8/13 withdrew but results were reported) Inclusion: • Aged ≥ 18 years • Non-cavity chronic hard-to-heal wound with a static or deteriorating condition in the previous 4 weeks Exclusion: • Wound infection based on clinical signs • Sensitivity to iodine • Thyroid disorders • Pregnancy/breast feeding • Taking lithium • Characteristics of pressure injury participants: • Mean age 73.4years (range 52 to 93) • All participants had pressure injuries Category/Stage III to IV (EPUAP grading) Mean PU duration 12 months (range 3 to 24 months)	• The test dressing was applied directly to the cleansed wound in accordance with the manufacturer's instruction • Dressing change frequency was based on the wound status and local practice • The dressing was used for the duration of 6 weeks •	• Measurements (size, depth) derived from digital photographs • Condition of wound margins • Condition of wound bed and peri-wound skin • Exudate type and amount • Patient-rated satisfaction with the test dressing	• 8/13 participants with pressure injuries withdrew from the study prior to 6 week conclusion. Reasons for withdrawal were: ○ 2/8 infection requiring removal from study ○ 3/8 maceration or increase in PU size ○ 2/8 not-related to dressing ○ 1/8 undisclosed reason relating to dressing **Mean wound area reduction** Mean percentage in wound area reduction over 6 weeks was 13.1% for PUs **Pressure injury condition** • 9 pressure injuries improved in condition, 3 remained static and 1 deteriorated (note that these results do not match the reasons for withdrawal which imply at least 5/8 PUs had a deteriorated condition) **Conclusions: the glucose oxidase dressing was associated with complications requiring its cessation in more than half the patients, including development of pressure injury infection and increase in size.**	• Lack of a control group • Differences in 'best practice' procedures at the various clinics • Inter-clinician variability in the wound assessments many were subjective • High dropout rate, 38% of the entire population and 62% of participants with pressure injuries	**Level of evidence: 4** **Quality: Low**
Günes & Eşer, 2007	RCT **comparing a honey dressing to ethoxy-diaminoacridine (0.1%) solution plus**	Participants were recruited from a hospital in Turkey (n=26 participants) Inclusion criteria: • Category/Stage II or III pressure injury	• Participants were randomly assigned (stratified by age, gender and baseline wound surface area) to receive either: ○ Unprocessed honey (raw, natural, organic and unpasteurized) with a minimum inhibitory	• PUSH measurements • Acetate tracings for area • Mobility levels assessed via Braden subscale	**Complete healing** 20% wounds treated with honey healed compared with 0% in comparator group ($p<0.05$) **PUSH scores** • At 5 weeks the honey group had significantly better PUSH scores	• No blinded assessment • Methods of randomization and allocation concealment not reported	

	nitrofurazone cream for healing Category/ Stage III pressure injuries	• Expected survival of > 2 months Exclusion criteria: • Diabetes mellitus • Terminal illness Participant characteristics: • Mean age approximately 65 years • Primarily sacral and trochanter pressure injuries • At baseline, no sig diff in age, gender, BMI, mobility level, Hgb and stage between groups • 96% of pressure injuries were Category/Stage III pressure injuries	concentration (MIC) of 3.8% that was sterilized with radiation (n=15 people with n=25 pressure injures), or ○ ethoxy-diaminoacridine (EDC) soaked dressing followed by nitroflurazone (Furacin®) cream (n=11 people with n=25 pressure injuries) • Both groups had a transparent film as secondary dressing and dressings changed daily or as necessary • Groups had the same pressure redistribution and a turning and repositioning program • Treatment continued until the wound healed or a maximum of 5 weeks	• Evaluated weekly by non-blinded researchers	than the control group1(2.62±2.15 versus of 6.55±2.12, p<0.001) • Differences in PUSH score were significant at all weeks after baseline **Author conclusions: Treatment with honey is superior to ethoxy-diaminoacridine solution plus nitrofurazone**	• Variability exists in honey formulas that might influence results • No comparison to standard contemporary wound dressings	
Clinical question 3: What wound dressings are effective for pressure injuries with higher levels of exudate?							
Van Leen, Rondas, Neyens, Cutting, & Schols, 2014	Case series exploring super-absorbent dressings for pressure injuries	Convenience sample of participants recruited in nursing homes and wound clinics in Netherlands and UK (n=11 people with pressure injuries, n=20 with venous leg ulcers) Inclusion criteria (for pressure injuries): • Category/Stage pressure injury II to IV • No use of test dressings in preceding 4 weeks • Aged 18 to 90 years Exclusion criteria (for pressure injuries):	If granulation tissue was observed, absorbent dressing A (Sorbion® Sana® wound dressing) was applied (n=6) If granulation tissue was observed, Cutimed® Sorbion® sachet S was applied (n=5)	• EPUAP 2009 classification system • PUSH scores • Surface area calculated as length vs width • Exudate level • Tissue type •	**Mean PUSH score (includes measure of exudate)** Mean PUSH score decreased by week at from 11.05 in baseline and 5.0 at week 8 **Mean surface area in cm²** There was reduction in mean surface area from 15.27cm² at baseline to 7.63 cm² at week 8 **Influence on affect and socialization** Participants rating the wound as having a negative impact reduced from 54.5% at week O to 18.1% at week 8 **Pain**	• Very small trial • Non-blinded outcome measurement • No comparison group • Selection is not well described •	**Level of evidence: 4** **Quality: Moderate**

		• Pressure injury of more than 3 weeks duration • Necrotic wound • Deteriorating pressure injury • Wound with deep crater • Severe medical condition (including malnourishment) • Participant characteristics (pressure injuries): • Mean age 64.6 years (range 43 to 83) • 27% Category/Stage III and 73% Category/Stage IV pressure injuries • 100% had heavy exudate			Pain reduced from 3.69 on 11 point VAS at baseline to 0.67 on VAS at week 8 **Conclusions: High absorbency dressing can contribute to improving quality of life**		
Gorska et al., 2017	An invitro lab study **exploring method of preparation of asymmetric polymeric membrane dressing and to explore characteristics associated with exudate management (water transport)**	Not applicable (in vitro study)	There is no intervention	• Structural and mechanical properties measured with magnetic resonance imaging and micro-computed tomography • Water transport	**Structural and mechanical properties** • Dry wound dressing is consisted of solid, homogenous skin layer, characterized by high proton signal intensity and spongy, porous layer • Material had asymmetric structure • Gradual decrease of piercing resistance occurred within 24 hours **Water Transport** • The weight of dressing increases 41% (1 hour), 69% (after 4 hours), 80% (8 hours) and 83% (after 24 hours). • Water uptake during the first 6 min of hydration (R^2 =0.9920) with the rate of 2.3%/min (95% confidence interval [CI] 2.00% to 2.57%).	• In vitro study, consideration should be taken prior generalization into clinical setting	**Indirect evidence: laboratory study**

					• Swelling process increased 18 mm^2 (within first 4 hours) and 4 mm^2 (until 24 hours).		
Diehm & Lawall, 2005	Observational study evaluating management of chronic, exuding wounds with a hydropolymer dressing	Physicians selected patients for the study from three centers. (n=1793 people with pressure injuries) Inclusion criteria: 4 weeks duration of wound; therapy adjusted based on severity of symptoms and course of healing. No exclusion criteria Participant characteristics (just pressure injury participants) • Age mean 74.5±13.6 • Mean wound age 2 months • Wound radius 2.6 cm±1.6 • Wound depth = 38.6% deep, 9.2% had wound pouches/deep wound pouches. Only 4,5% superficial. • Infection 47.2% • Exudate 36.7% little, 28.4% medium, 14% strong • Odor 23.9% none; 39.7% little; 25.4% medium; 9.5% strong • Necrotic tissue 19.9 % none; 49.8% small; 25.6% extensive; 4.2 entire • Portion of fibrinous adhesion 9.7% none, 53.9% small; 31.5% extensive 2.3% entire	Dressings changed 3 times a week	• Changes in wound radius and % change in wound area • Signs of infection • Level of exudate • Wound odor • Portion of necrotic tissue • Portion of fibrous adhesion • Wound status = healed, improved, unchanged aggravated • Compliance with therapy much better, better, equal or worse • Data at baseline, 4 or 12 weeks. • Estimate of exudates were scored as: 1= none, 2= little/small, 3=medium/extensive, 4=strong/entire area	**Pressure injury healing** • After 4 weeks mean wound radius was 67.4% smaller with 77.9% reduction in wound size: 38.9% healed; 55.9% improved; 3.3% unchanged and 0.2 aggravated • After 12 weeks: 79.1% reduction in wound radius with 87.5% reduction in wound size: 57.8% healed, 39.3% improved; 2.5 unchanged and 0.2% aggravated **Adverse effects** • Withdrawals from study were 4.5% for insufficient efficacy, intolerance and worsening of the wound • Adverse effects occurred in 2.9% and were pain, general intolerance and itching	• No control group for comparison • Participants selected by physicians treating them and doing assessments • Confounders not identified and considered, minimal information about overall health of participants, and their concurrent management	**Level of evidence: 4** **Quality: Moderate**

Moberg, Hoffman, Grennert, & Holst, 1983	RCT evaluating the effectiveness of cadexomer iodine for managing exudate and debris in pressure injuries	Participants were recruited by unreported methods in a hospital in Sweden (n=38)
		
		Inclusion criteria:
		None stated
		
		Exclusion criteria:
		Moribund or psychiatric condition
		Malignancies
		Iodine sensitivity
		
		Participant characteristics:
		Mean age ranged from 72 to 80 years but not significantly different between groups
		Mean duration of PI was 6.2 months
		Depp ulcers (8 in standard group and 10 in cadexomer iodine group) and Superficial ulcers (10 in standard group and 6 in cadexomer iodine group)
		Mean size at baseline 12.4±4.3 in standard group and 9.6±1.8 in cadexomer group
			• Participants were randomized to receive either:
			  ○ Cadexomer iodine applied daily at 3mm thick, removed after 24 hours with water/saline (n=19)
			  ○ Standard treatment, individualized to patients including saline dressings, enzyme-based debriding agents and non-adhesive dressings (n=19)
			• Nutrition, hygiene, pressure redistributing mattress, repositioning was all equal between patients
			• Treatment when healing was not occurring at 5 weeks, participants could swap groups
				• Classification as deep or superficial wounds
				• Change in ulcer size measured as planimetry performed using tracing and longest diameter
				• Quantity of pus and debris measured by physicians on 100mm VAS
				• Pain measured by patients on 100mm VAS
					Change in pus and debris
					• Both groups had a significant reduction in mean score compared to baseline, but the cadexomer iodine reduction in score was significantly greater than the standard therapy group (p<0.05)
					
					Change in size
					• Three standard treatment group switched groups at 3 weeks
					• Mean reduction in size at 3 weeks was 31% in cadexomer group and 19.5% in standard group
					• At 8 weeks both groups had significant reductions in size (76% in cadexomer group and 57% in standard group) (p<0.05 between groups)
					
					Percent wounds with >50% reduction in area
					1 ulcer in standard group versus 8 in cadexomer group (p<0.01)
					
					Adverse events
					• 2 participants in cadexomer iodine group withdrew because they though they were getting worse
					• 1 participant in cadexomer iodine group withdrew due to skin irritation
						• Participants who withdrew at 3 weeks were not reported in analyses
						• Standard group were a bit larger at baseline so more opportunity for improvement
						• Non blinded assessment, no ITT analysis
							Level of evidence: 1
							
							Quality: Low

Bale et al., 1997	RCT comparing a polyurethane foam dressing to a hydrocolloid dressing in respect to	Participants were recruited via unreported methods in 5 centers (n=61) Inclusion criteria: • Aged >18years • Not pregnant	• Participants received either a polyurethane foam dressing Allevyn Adhesive) (n=29) or a hydrocolloid dressing (Granuflex) (n=31)	• Absorbency, ease of use variables measured as yes/no (unclear whether this is patient or nurse rated) • Follow up to healing or maximum 30 days	**Pressure injury healing** 24% of the polyurethane foam group vs 16% in the hydrocolloid dressing group (no statistical analysis). **Use and adhesive** 7% of polyurethane foam group and 18% of hydrocolloid group rated	• 62% of the foam group and 22% of the hydrocolloid group withdrew from the trial	**Level of evidence: 1** **Quality: Low**

	ease of application and adhesive properties	• No history of poor compliance • Category/Stage 2 or 3 pressure injury not bigger than 11cm diameter Participant characteristics: • Primarily Category/Stage 2 pressure injuries (79% of the polyurethane foam group and 71% of the hydrocolloid group) • The rest of pressure injuries were Category/Stage 3 • One third in each group had no exudate, 41% of the foam group and 10% of the hydrocolloid group had moderate exudate, all the result were slight) • More than 50% in both groups were <10cm^2			dressing as awkward for application This was primarily for heel pressure injuries. 96% of polyurethane foam group and 76% of hydrocolloid group rated dressing as good for conforming to body (p=0.018) Mean wear time was 3.8 days for polyurethane group and 3.2 for hydrocolloids **Absorbency** 81% of foam dressing group and 26% of hydrocolloid group rated the dressing as good absorbency (p<0.001) 25% of foam dressing group and 4% of hydrocolloid group experienced soiling to clothes/bedclothes (p=0.02) Author conclusions: for absorbency and ease of use, polyurethane foam is superior to hydrocolloid	• Funded by dressing manufacturer	
Diehm & Lawall, 2005	Observational study reporting data from three studies exploring hydropolymer dressings for managing healing and wound exudate different wound types, including Category/Stage III and IV	Physicians selected patients for from across Germany using unreported methods over 4 years for 3 different studies (n=1793 pressure injuries) Inclusion: 4 weeks duration of wound No exclusion criteria Participant characteristics: • Mean age 74.5±13.6 • Mean wound age2 months • Wound radius 2.6 cm ±1.6	• All pressure injuries treated with Tielle™ (Johnson and Johnson) hydropolymer dressings • Dressings changed 3 times a week • Therapy adjusted based on severity of symptoms and course of healing	• Data were recorded at baseline and at 4 or 12 weeks. • Estimate of exudates were scored as: 1= none, 2= little/small, 3=medium/extensive, 4=strong/entire area • Changes in wound radius and % change in wound area • Signs of infection • Level of exudate • Wound odor • Portion of necrotic tissue	**Exudate management at 12 weeks** 57.8% healed, 12.9% no exudate,24.3% little exudate, 3.0% moderate exudate, 0.8% large exudate **Adverse events** • Withdrawals from study were 4.5% for insufficient efficacy, intolerance and worsening of the wound • 2.9% experienced pain, general intolerance and itching	• Wound healing outcomes reported elsewhere in table • Combined results from these three studies that had similar objectives • No control group for comparison • Method of wound assessment may not have been consistent across studies	**Level of evidence: 4** **Quality: Low**

	pressure injuries	• Wound depth 38.6% deep, 9.2% had wound pouches and deep wound pouches • Infection = 47.2% • Exudate 36.7% little, 28.4% medium, 14% strong • Necrotic tissue 19.9 % none, 49.8% small, 25.6% extensive, 4.2% entire		• Portion of fibrous adhesion • Wound status = healed, improved, unchanged aggravated		• Large number of participants not followed for full reporting period	
Parish et al., 2008	Prospective non-comparative observational study **investigating an ahesive gelling foam wound dressing (GFD-A) for promoting healing in primarily Category/Stage III or IV pressure injuries**	Participants were recruited from 6 US centres and 1 Canadian centre (n=23, n=16 completed 28 days) Inclusion: • Stage II pressure injury ≥2 cm^2 or stage III or IV pressure injury Exclusion: • Category/Stage I pressure injury • Category/Stage PU < 2cm^2 or pressure injury of size greater than 11.6cm x 15.5cm (maximum dimensions of dressing product) Characteristics: • Co-morbidities not reported • Mean age 57.6±20.8 years (range 18 to 97) • 61% sample males • Most pressure injuries were Category/Stage III or IV (61%) • Mean pressure injury • duration 1.0±1.8 years (range 0 to 8) • Mean pressure injury	• All participants used appropriate pressure relieving devices • Wounds were debrided using the sharp method and cleansed at commencement of study. • All participants treated with: ○ An adhesive gelling foam wound dressing (AQUACEL® Hydrofiber) in either a ribbon or dressing size. • Concurrent skin barrier creams and securing aids/bandages varied according to clinician preference. Dressing changes were done at least once every 7 days.	• Secondary outcomes: ○ Exudate management assessed as excellent, good, fair or poor	**Condition of periwound** • 65% of participants had peri-skin described as healed, mild improvement or marked improvement; 22% had no change in surrounding skin, 13% had deteriorated condition of surrounding skin.	• Healing outcomes reported elsewhere in table • Small sample; high attrition • >20% non-response on subjective measures of dressing • Supported by a grant from company supplying product • The hydrofiber dressing was primarily used as a wound filler (50% of all dressing changes) although this is not its primary intended use.	**Level of evidence: 4** **Quality: low**

		• size 10.6±16.4cm2 (range 0.8 to 62.5) • Mean pressure injury • depth 5.7±8.8mm (range 0 to 40) • 305 sacral, 22% heel, 4% ischial, 4%trochanter, 39% other location • Exudate: 52% moderate, 39% minimal, 9% heavy • 9% clinically infected					
Apirag Chuangsuwanich, Charnsanti, Lohsiriwat, Kangwanpoom, & Thong-In, 2011	Prospective randomized clinical trial **comparing a silver dressing to silver sulfadiazine cream for Category/Stage III and IV pressure injuries**	Participants were recruited from an in and outpatient clinic in Thailand (n=40) Inclusion: Category/Stage III or IV pressure injury Characteristics: • Mean age 62.6 to 69.1 years • No significant difference for blood results at baseline, including albumin levels <3.5 in both groups suggesting possible malnutrition • SSD cream group had significantly larger PU at commencement of study (12.17 versus 22.82cm^2)	• All pressure injuries were debrided if required. • Participants were randomly assigned to receive: ○ wound beds covered with silver sulfadiazine (SSD) cream applied daily (n=20) ○ silver mesh dressings TEGADERM® Ag mesh) applied every 3 days (n=20) • Treatment was for 8 weeks	Data collected at the beginning of the study and every two weeks thereafter: • Wound size (planimetry) • Wound photography • PUSH score • Bacterial wound culture Study period was eight weeks for each participant	**Wound area reduction** Silver mesh dressing was superior to SSD cream for reduction in wound area at 8 weeks (18.22 versus 7.96 and cm², p=0.093) **Healing rates** • There was no significant difference between groups for PU healing rate after 8 weeks (36.95% in the mesh group and 25.06% in the SSD group, p=0.507) **PUSH score** • The means of PUSH score were 11.4 (mesh) and 13.4 (SSD cream) at commencement and 7.55 (mesh) and 9.6 (SSD cream) after 8 weeks. **Study conclusions: considering the significant difference in wound size at commencement of this study, there appears to be no significant difference between a silver dressing and topical SSD cream for healing in pressure injuries.**	• Small trial, no power study • No placebo control • No blinding • Groups not comparable at baseline • Unclear treatment (e.g. dressing applied over SSD cream?) • Non comparable management (dressing changes at different frequency) • Unclear co-morbidities	**Level of evidence: 1** **Quality: low**
Clinical question 4: Which wound dressings are the most cost-effective for healing pressure injuries?							

Lima, Castilho, Baptista, Rogenski, & Rogenski, 2016	Identify the average direct cost of materials and solutions used in performing dressings for pressure injuries	Study conducted in teaching hospital in Brazil using convenience sampling (39 patients/ 228 dressings performances) Inclusion/exclusion data are not clear Participant characteristics: • Category/Stage I pressure injuries 8.8%; Category/Stage II pressure injuries 23.68%; Category/Stage III pressure injuries 24.56%; Category/Stage IV pressure injuries 30.26% • Mostly sacral region (71/8%)	Regimens were determined by Category/Stage and primarily involved hydrocolloid dressings for Category/Stage I and II pressure injuries, papain, gauze and rayon bandage for Category/Stage III pressure injuries and compounded silver, rayon and gauze for Category/Stage IV pressure injuries	• Observation period over six months • Braden scale was applied to prevent and measure risk of pressure injuries • [Time (spent by nursing professionals) X Cost of direct labor] + cost of materials & solutions	**Average direct cost of dressing performance** • Category/Stage I – US$19.18±11.80 • Category/Stage II – US$6.50±7.68 • Category/Stage III -- US$12.34±11.24 • Category/Stage I IV – US$ 5.84±7.02 • Unclassifiable pressure injury – US$ 9.52±8.60 • Suspected deep tissue injury– US$3.76±2.46	• Dressings performed by secondary education level professionals (mainly nursing technicians) • Does not consider number of dressing changes required • No comparison of costs between treatments	**Quality: Low**
A. Chuangsuwanich et al., 2013	RCT comparing alginate silver dressing (AISD) and silver zinc sulfadiazine cream (SSD) in terms of cost-effectiveness in treatment of pressure ulcers	Participants recruited from outpatient department of university hospital based in Thailand (n=22 randomized, n=20 analyzed) Inclusion criteria: • Category/Stage III or IV sacral or trochanteric pressure injuries • Aged > 20 • Informed consen • Attend weekly follow-up Exclusion criteria: • Pressure injuries needing extensive debridement • Infected pressure injuries	• All wounds debrided as necessary • Participants were randomly assigned to receive either: • AISD (Askina® Calgitrol® Ag, B. Braun Hospicare Ltd.) applied to wound every 3 days (n=11 randomized, n=10 analyzed), or • SSD cream and dry gauze applied to wound daily (n=11 randomized, n=10 analyzed).	• Treatment cost estimated from products used	**Treatment cost** • Mean dressing unit cost (staffing and dressing products) estimated at 8.06 USD and debridement cost 16.13 USD • Treatment with SSD cream significantly more expensive than with AISD (treatment cost of 467.74 vs 377.17 USD, p=<0.001) **Author conclusion: AISD can be used for Category/Stage III and IV pressure injuries with a better wound healing profile than conventional treatment.**	• Efficacy for healing reported elsewhere in data table • comparison between standard care or control. • Variation in treatment applications which would bias treatment cost estimates.	**Quality: Moderate economic analysis**
Silva et al., 2017	Cost analysis evaluating direct cost of dressings	Consecutive participants were recruited in a one-month period in an ICU in Brazil (n=15)	Wound dressings as selected by clinical staff and consisted of SSD cream, papain, fatty acids, sterile gauze and micropore tape	• Portuguese version of the Pressure Ulcer Scale for Healing (PUSH)	**Cost of dressings based on wound condition** Mean cost per pressure injury was USD$11.9±7.4 (range 5.2 to 27.7)	• Small sample • Limited to topical treatment (essential fatty	**Quality: Moderate**

	in pressure injury treatment	Inclusion criteria: • 18 years or older • Undergoing treatment for pressure injury of Category/Stage II to IV (or unstageable) Exclusion Criteria: • Does not require wound dressing • Death or transfer to another unit Characteristic: • More female than male • All participants were bed-ridden		• Cost calculation was based on the amount of material used in each dressing procedure per observation and their unit value • Participants assessed 5 times with a four-day interval in between each assessment, by the researchers • Follow period: 20 days	Cost increased by Category/Stage, with unstageable costing more than Category/Stage III and less than Category/Stage IV There was an increase in average dressing cost associated with moderate exudate compared with light exudate or no exudate Dressing change was more expensive for pressure injuries with malodor **Change in cost over time** There was a reduction in mean total cost between initial and final assessments (5 assessments per wound, p= 0.002) Cost reductions over time correlated to PUSH scores, change in tissue type and reduction wound exudate **The authors concluded that cost of attending dressings for pressure injuries is dependent on the Category/Stage of pressure injuries**	acids and silver sulfadiazine), other treatment technique and industrialized dressings were not used • The total cost of dressing materials were based on 5 observations per patient	
Souliotis et al., 2016	RCT evaluating **cost and clinical effectiveness analysis between moist wound healing dressings and gauze in a homecare setting for Category/Stage III and**	• Participants were recruited from homecare in Greece (n=100) Inclusion criteria: • Category/Stage III or IV pressure injury requiring a wound dressing Exclusion criteria: • Age <18, • End stage chronic heart disease, dependent diabetes, cancer, serious immunodeficiency, severe systematic infection,	• Participants were randomized to receive either ○ moist wound healing dressings, including foam dressings, silver foam dressing, silver sulfadiazine dressing, ibuprofen-releasing foam dressings (n=50 randomized, n=47 analyzed), or ○ Plain gauze dressing (n=50 randomized, n=48 analyzed) • All pressure injuries cleansed with normal saline and if signs of colonization or infection povidone or other antiseptic solutions were used	• Total product cost until wound healing, daily wages & cost of healthcare persons per home visit, cost of other materials including gloves, saline, syringes, antiseptics, and adhesive tapes • Ulcer size measurement with sterile transparent graded films • Data collection and ulcer measurements	**Average wound healing time** Moist wound healing dressing group had significantly faster wound healing times compared to control group (85.56±52.1 days vs 121.4±52.2 days, p = 0.0001) **Dressing change frequency** Moist wound healing dressing group had significantly fewer wound dressing changes compared to control group (49.5±29.6 vs 222.6±101.9, p<0.0001) **Total treatment cost**	• Did not include travel costs to patient • Medium-sized pressure injuries were selected, but larger pressure injuries have higher treatment costs and longer healing duration • The faster healing among	**Quality: Low**

	IV pressure injuries	• Previous pressure injury treatment with a different method Participant characteristics: • Mean age 75 to 77 years • Mean surface area from 41.5cm^2 to 43.5cm^2 • Primarily located on coccyx or trochanter		was done once a month until complete healing	Average treatment cost per patient until healing achieved was lower for the moist wound healing dressings compared with control (€1,351 vs €3,888)	moist wound healing dressings could relate to using topical antimicrobials • Wide range of products used so it is difficult to determine if any specific contemporary dressing is superior	
Graumlich et al., 2003	RCT comparing **collagen dressing to a hydrocolloid dressing for primarily Category/Stage II pressure injuries, including cost analysis**	Participants were recruited from 11 nursing homes in the US (n=65 recruited, n=65 analyzed) Inclusion criteria: Aged above 18 years Stage 3 or 3 pressure injury Exclusion criteria: Allergy to products Osteomyelitis, cellulitis, malnutrition Eschar or necrosis of pressure injury Participant characteristics: • Mean age approx. 80 years • Mean duration of pressure injury 3 to 6.5 weeks • Mean Braden score around 12 • About 80% had stage 2 pressure injury and 20% with stage 3	• All pressure injuries received • Participants were randomized to receive: ○ Collagen dressing: sterile saline applied, collagen sprinkled in thin continuous layer over wound bed, gauze applied (n=35), or ○ Hydrocolloid (n=35) • Treatment for 8 weeks or to complete healing (whichever first) • Stratification by diagnosis of diabetes	• Digital photography, length, width, depth • Outcomes measured by blinded clinical nurses • Cost analysis	**Cost analysis** • Considering dressing materials, ancillary supplies and labor costs, collagen dressing was more expensive that hydrocolloid dressing for 8 weeks (average per patient cost hydrocolloid $222 versus collagen $627) ($US in 2003) • Collagen dressings required 7 nursing interventions per week versus 2 for hydrocolloid. **Author conclusions: Collagen dressing has no advantage over hydrocolloid and is more expensive to use.**	• Wound healing outcomes reported elsewhere in table • 17% lost to followup (equivalent between groups) but used ITT analysis • Blinded outcome measurement and analysis	**Quality: low**
Suspected deep tissue injuries, uncategorized pressure injuries and unclear reporting of Category/Stage pressure injuries							

Sullivan, 2015	To explore the evolution of suspected deep tissue injury (sDTI) pressure ulcers and the use of **soft silicone bordered foam dressing for treating sDTI and preventing further deterioration**	Participant records were retrospective review over 24 month period in one facility in the US (n= 77 participants with 128 sDTIs) No inclusion or exclusion criteria stated. Participant characteristics: • 89.84% had purple/maroon discoloration, 6.25% had blood filled blister • 39.84% located on sacrum/coccyx, 28% on heel, 14% elsewhere on foot	• 75.7% participants received absorbent soft silicone self-adherent multi-layered bordered foam dressings (Mepilex®) as primary on a sDTI • 7.3% participants received absorbent soft silicone self-adherent multi-layered bordered foam dressings as secondary dressing on sDTI • All participants received a pressure injury prevention bundle • 85.7% received a low-air-loss mattress and 14.2% received a high-density foam mattress	• Pressure injury was evaluated by WOCN nurses and classified as healing, no change or deteriorating • sDTI staging using NPUAP staging guidelines • Evaluated for between 1 day and 14 weeks.	Of the 128 sDTIs followed up, 75.7% (n = 80) used a silicone self-adherent multi-layered bordered foam as the primary dressing, and 7.3% (n = 17) as a secondary dressing. **Condition of sDTI after 1-14 days** Of the 128 sDTIs followed up 31 (24.2%) remained the same, 12 (9.3%) deteriorated to full thickness tissue loss and 85 (66.4%) progressed towards resolution. **Author Conclusion: sequelae of sDTI is not inevitable and that use of an absorbent soft silicone self-adherent multi-layer border foam can change trajectory of sDTIs.**	• Poorly written and difficult to identify clear results. • No objective measures of wound clinical condition and interrater reliability not established • Participants did not receive the same other preventive care • Different follow-up periods • Study setting used silicone foam dressings as standard care, therefore unable to compare with other centers.	**Level of evidence: 4** **Quality: low**
Kordestani et al., 2008	Randomized controlled trial **comparing wound healing rates between a bioactive dressing and gauze.**	Participants were recruited from 5 major teaching hospitals in Iran (n= 85 participants with 98 wounds, 51 participants with 60 wounds completed the study and included in analysis) Inclusion Criteria: • wound regardless of etiology, size or depth Exclusion Criteria: • Pregnancy	• Wounds debrided at commencement as required. • No concurrent use of pressure relief products or offloading. • All wounds irrigated with normal saline and treated for 21 days with either: ○ Study group: a bioactive advanced wound dressing containing chitosan (derived from sea crustacean) and polysaccharide alginate that was available in various forms including transparent film, gel, impregnated pads and a	Recorded at every dressing change: • Wound size by photography and planimetry • Stage (where appropriate) using NPUAP staging classification • Presence of infection using wound swab and culture for wounds showing clinical signs of infection	**Healing outcomes** At 21 days, there was significantly greater number of pressure injuries that achieved complete healing (68.75% versus 25%, p<0.05) Control group pressure injuries • 4 healed (3 stage I and one stage II) • 8 deteriorated in condition by day 21 based on NPUAP staging • 75% of wounds required antibiotic therapy for clinical infection	• 1200 participants were screened for inclusion but 1115 did not meet criteria or did not consent • High dropout (>30%) that was not equivalent between groups (3% in study group, 57.6% in control) • Unclear if Category/Stage	**Level of evidence: 1** **Quality: low**

		• addiction to alcohol, narcotics or tobacco • Immunocompromising conditions Characteristics: • Co-morbidities not reported • Mixed aetiology wounds, approximately 50% pressure injuries in both groups • mean age 43.42±5.08 years • Mean wound length 14.13±2.3cm • Mean wound width 8.24±1.92cm • Mean wound duration 21.5±6.2 days	powder. Dressings were changed every 2 to 4 days. (n=33 randomized, n=32 completed and analysed, of these 16 were pressure injuries) • Control group: covered with gauze secured with a bandage and adhesive tape. (n=52 randomized, n=22 completed and analysed of these 12 were were pressure injuries)	• Follow-up: 3 month post-treatment	Treatment group pressure injuries • 11/16 healed completed • 2 stage IV PUs reduced slightly in size • All were healed by 3 months • 0% wounds required antibiotics	equivalent between groups • Poor randomization and blinding methods, no intention-to-treat analysis, unclear comparability of results between sites • Long follow up (3 months) after short treatment period (21 days) • Control group received only gauze dressings • Although it was a double blind study, some participants already observed that the bioactive dressing benefits them prior to the entry of study.	
Other miscellaneous studies: Dressings adhesives							
Kohta & Iwasaki, 2015	Observational study investigating influence of tack adhesive in hydrocolloid dressing performance	Healthy volunteers aged 28 to 38 years Hairless mice	• Ceramide-2 containing hydrocolloid dressings with different tack adhesive concentration ratios (hydrocolloid: tack adhesive) 5 samples: 100:0, 95:5, 90:10, 85:15, 80:20 • Lab study: Dressing applied to a stainless steel surface using a press load for 5 secs • Healthy volunteers:	Outcome measures were: • Initial tack force (force required to remove dressing after 5 secs at speed of 10mm/sec) • Peel force (force required to peel dressing at speed of 5mm/sec)	**Tack force** • Tack force significantly increased ($p<0.05$) as lack concentration increased **Peel force** • Peel force significantly increased ($p<0.05$) as the tack concentration increased at 5 min removal point. • There was no significant difference in peeling forces between samples at 7 hour and 72 hour removals	• Healthy young volunteers and mice – performance on older and/or unhealthy skin may vary	**Indirect evidence: healthy volunteers and animals**

			3 samples each dressing (i.e. 15 samples) applied to back of volunteer using 2kg roller weight and removed at 20 mins, 7 hrs and 72 hrs • Hair-less mice: wet and dry specimens of two dressings (100:0 and 80:20) applied and removed after 5 minutes, experiment repeated 10 times	• Stratum corneum (SC) removal: observed under microscope on dressings	**SC removal** • Non-significant increase in SC removal with increase in tack adhesive concentration at 20 minutes, but difference was not evident at 7 hours • **Conclusions: the hydrocolloid dressing had increased adhesiveness with increased tack under dry conditions and there were no differences in adhesive under wet conditions.**		

Systematic reviews to support discussion

Ref	Type of Study	Sample	Intervention(s)	Outcome Measures & Length of Follow-up	Results	Limitations and comments	
Dumville et al., 2015	Systematic review **exploring the effectiveness of alginate dressings for pressure injuries of Category/Stage II or greater**	The review included RCTs (including cross-over designs but excluding quasi randomized studies) reporting outcomes for participants with Category 2 or greater RCTs. N=6 RCTs, n=336 participants)	• Alginate dressings • Comparisons included: • Different alginate brands, hydrocolloid dressing , silver-alginate dressing, silver-zinc sulfadiazine cream, an dextranomer paste,	Primary outcome measure was complete wound healing measured as: • Time to complete healing • Proportion of PUs healed during follow up Secondary outcome measures included: Change and/or rate of change in wound size • QOL • Infection • Adverse outcomes • Resource use/cost • Wound recurrence	**Alginate versus hydrocolloid (1 study (Belmin 2002), n=110)** Low quality evidence that alginate-hydrocolloid is associated with greater reduction in mean percentage wound area than plain hydrocolloid (69.1% versus 42.6%, mean difference 26.5, 95% CI 10.62 to 42.38) **Alginate versus Dextranomer paste (1 study (Sayag 1996), n=92)** No difference between alginate and dextranomer paste for wounds requiring systematic antibiotics (4.3% versus 4.4%, risk ration [RR] 0.96, 95% CI 0.13 to 1.13) **Silver-alginate versus plain alginate (1 study (Meaume 2995, n=48)** No difference between silver alginate and plain alginate for proportional reduction in wound size (31.6% versus 13.9%, mean difference 17.7%, 95% CI –13.07 to 48.47)	• The SR includes the 2 studies reported in the 2014 clinical guideline and one study A. Chuangsuwanich et al., 2013 identified in the 2019 search. Additional 3 studies published pre-2009 guideline. • All small, under-powered studies with short follow up and virtually none reported completed healing. • No meta-analysis conducted	**Quality: high**

Ref	Type of Study	Sample	Intervention(s)	Outcome Measures & Length of Follow-up	Results	Limitations and comments	
					No significant difference in assessment as being infected		
Dumville Jo, Stubbs, Keogh Samantha, & Walker Rachel, 2014	Systematic review **exploring the effectiveness of hydrogel dressings for pressure injuries of Category/Stage II or greater**	The review article Included 11 studies (523 participants) from a range of countries Inclusion criteria: • RCT studies • pressure injuries Category/Stage II or above • Primary intervention hydrogel Exclusion criteria: • Non RCT studies • did not evaluate hydrogel • did not report a relevant outcome • included pressure injuries Category/Sage I • hydrogel was not the only systematic difference between trial groups	Regimen for intervention group: • Hydrogel Dressing Regimen for control/comparison group: • Basic wound contact, including saline gauze (3 studies). • Hydrocolloid (3 studies). • Another Hydrogel dressing (3 studies). • Foam (1 study). • Dextranomer paste (1 study). • Topical Colagenase (1 study).	The review article evaluates following studies with outcomes: • Primary outcomes were time to complete wound healing, and proportion of healing during follow-up period • Secondary outcomes were changes and rate of change in wound size, health related quality of life/health status, pain, resources, recurrence	**Hydrogel dressings compared with basic wound contact dressings** • There was no difference in the number of ulcers completely healed in the hydrogel-dressed group compared to basic wound contact-dressed group (1 study, RR 0.97 (95%CI 0.56 to 1.68) • There was a significant difference in the mean difference of -38% in favour of hydrogel (1 study, 95% CI -50.49 to -25.51) • Mean percentage reduction per week in wound size had a mean difference 2.9%, (95% CI -6.27 to 12.07) (1 study) • Median pain score and associated range for both groups was the same (1 study) **Hydrogel dressings compared with hydrocolloid dressings** • Healing rate was higher for hydrogel vs hydrocolloid dressing for Category/Stage II pressure injuries (1 study, 32% vs 16% (group) in pressure ulcer stage II • Healing rate was 40% for both hydrogel dressing and hydrocolloid dressing (1 study, RR 1.00, 95% CI 0.22 to 4.56). • Wound area reduction was the same for hydrogel dressing and hydrocolloid dressing (1 study, both 34%). • Mean cost of treatment was cheaper with a hydrogel vs a hydrocolloid, (1 study, USD57.76 (SD 18.9) versus USD 91.48 (SD 31.5), mean difference USD -33.72 (95% CI -65.92 to -1.52).	• No meta-analysis due to lack of data. • All small, under-powered studies with short follow up and virtually none reported completed healing.	**Quality: high**

Ref	Type of Study	Sample	Intervention(s)	Outcome Measures & Length of Follow-up	Results	Limitations and comments	
					Author conclusion: The effectiveness of hydrogel dressings, basic wound contact dressings, foam dressings, dextranomer paste, topical collagenase and compared with hydrocolloid brand dressings are unclear due to very few comparative data.		
Walker, Gillespie, Thalib, Higgins, & Whitty, 2017	Systematic review assessing **clinical and cost effectiveness of foam dressing for healing pressure injuries of Category/Stage II and above**	Review included RCTs (n=9 studies with n=483 participants) Studies included were conducted in a wide range of clinical settings in Europe, USA and UK Patient characteristic: • Average age for the patients 59 years or older • More female participants than male in 7 trials Exclusion criteria: Non-RCTs , clinical controlled trials and cross –over trials.	This review included studies that compared foam dressings with: • silicone foam dressing • hydrocolloid dressing • hydrogel dressing • basic wound contact dressing	• Incidence of healed pressure injuries • Time to complete healing • Adverse events per participant • Reduction in ulcer size • Quality of life • Patient satisfaction/ acceptability measured using any validated tool • Recurrence • Pain • **Follow up** range between short term (8 weeks or less) to medium term (8 to 24 weeks).	**Foam dressings vs hydrocolloid** • Incidence of healing, follow-up 8 weeks or less, Relative Risk(RR) 0.85, 95% CI 0.54 to 1.34, p,=0.77, 3 RCTs • Adverse events follow-up 8 weeks or less, RR 0.88 (95% CI 0.37 to 2.11, 3 RCTs **Foam dressings vs hydrogel** • Incidence of healing, follow-up 8 weeks or less, RR 1.00, 95% CI 0.78 to 1.28, 1 RCT • Adverse events follow-up 8 weeks or less, RR 0.33, 95% CI 0.01 to 7.65, 1 RCT **Foam dressings vs basic contact dressing** • Incidence of healing, follow-up 8 weeks or less, RR 1.33, 95% CI 0.62 to 2.88, p=0.46, 1 RCT • Incidence of healing, follow-up 8 to 24 weeks or less, RR 1.17, 95% CI 0.79 to 1.72, p=0.43, 1 RCT • Adverse events follow-up 8 to 24 weeks or less, RR 0.58, 95% CI 0.33 to 1.05, 1 RCT **Author conclusion: The reviewed trials were found to be of low to very low**	• The included trials were small and underpowered with wide confidence intervals. • Risk of bias is high due to small sample size • Short follow up time (Mean 8 weeks) • Analysis included silver foam dressings and ibuprofen foam dressings as well as polyurethane foam dressings	**Quality: high**

Ref	Type of Study	Sample	Intervention(s)	Outcome Measures & Length of Follow-up	Results	Limitations and comments	
					quality evidence and evidence of clinical superior effect was unclear.		
Westby, Dumville, Soares, Stubbs, & Norman, 2017	Systematic network analysis for any type of dressing for treating pressure injuries	Review included RCTs (n=39) comparing any type of dressing for treating pressure injuries	• Any type of dressing compared to any other type of dressings	Incidence of healing	**Dressing compared with saline gauze dressings for healing** • collagenase ointment (RR 2.12, 95%CI 1.06 to 4.22) • foam dressing (RR 1.52, 95%CI 1.03 to 2.26, 3 studies) • basic wound contact dressing (RR 1.30, 95% CI 0.65 to 2.58) • polyvinylpyrrolidone (PVP) plus zinc oxide (RR 1.31, 95% CI 0.37 to 4.62) • protease-modulating dressings (RR 1.65, 95% CI 0.92 to 2.94) **Probability of being the best treatment** • dextranomer 41% • tripeptide copper gel 25% **Probability of being the worst treatment** • sequential hydrocolloid alginate dressings 35% • sugar plus egg white 32%	• Studies generally have high risk of bias and are included I the other identified Cochrane reviews	**Quality: high**

Table 1: Level of Evidence for Intervention Studies

Level 1	**Experimental Designs** • Randomized trial
Level 2	**Quasi-experimental design** • Prospectively controlled study design • Pre-test post-test or historic/retrospective control group study
Level 3	**Observational-analytical designs** • Cohort study with or without control group • Case-controlled study
Level 4	**Observational-descriptive studies (no control)** • Observational study with no control group • Cross-sectional study • Case series (n=10+)
Level 5	**Indirect evidence**: studies in normal human subjects, human subjects with other types of chronic wounds, laboratory studies using animals, or computational models

Table 2: Levels of evidence for diagnostic studies in the EPUAP-NPUAP-PPPIA guideline update

Level 1	Individual high quality (cross sectional) studies according to the quality assessment tools with consistently applied reference standard and blinding among consecutive persons.
Level 2	Non-consecutive studies or studies without consistently applied reference standards.
Level 3	Case-control studies or poor or non-independent reference standard.
Level 4	Mechanism-based reasoning, study of diagnostic yield (no reference standard). Low and moderate quality cross sectional studies.

Table 3: Levels of evidence for prognostic studies in the EPUAP-NPUAP-PPPIA guideline update

Level 1	A prospective cohort study.
Level 2	Analysis of prognostic factors amongst persons in a single arm of a randomized controlled trial.
Level 3	Case-series or case-control studies, or low quality prognostic cohort study, or retrospective cohort study.

APPRAISAL FOR STUDIES PROVIDING DIRECT EVIDENCE (i.e. ELIGIBLE FOR SUPPORTING AN EVIDENCE-BASED RECOMMENDATIONS

Each criteria on the critical appraisal forms was assessed as being fully met (Y), partially met or uncertain (U), not met/not reported/unclear (N), or not applicable (NA). Studies were generally described as high, moderate, or low quality using the following criteria:

- High quality studies: fully met at least 80% of applicable criteria
- Moderate quality studies: fully met at least 70% of applicable criteria
- Low quality studies: did not fully meet at least 70% of applicable criteria

CROSS SECTIONAL/SURVEY/PREVALENCE STUDIES/OBSERVATIONAL

Endnote ID	Author/year	Focussed question	Sampling method	Representative sample	States number invited participants	Clear outcome measures	Valid reliable outcome measurement	Comparable results for multiple sites	Confounders identified and accounted for	Minimal bias	Reliable conclusions	Level of evidence	Quality
52	Ausili et al., 2013	N	N	N	Y	Y	Y	NA	N	N	N	4	Low
17155	Fowler & Papen, 1991	Y	N	U	Y	Y	N	NA	N	N	N	4	Low

RCTS

Endnote ID	Author/year	Focussed question	Assignment randomization method reported and acceptable	Adequate concealment method	Subjects and investigators blinded	Groups comparable at commencement	Only difference btw groups was treatment	Valid, reliable outcome measure	% drop out in study arms is reported and acceptable	Intention to treat analysis	Comparable results for multiple sites	Minimal bias	Reliable conclusions	Level of evidence	Quality
1476	A. Chuangsuwanich et al., 2013	Y	N	N	N	Y	U	Y	Y	Y	NA	N	N	1	Low
10882	Li et al., 2016	Y	N	U	N	Y	N	Y	Y	Y	NA	N	N	1	Low
13834	Souliotis et al., 2016	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	1	Moderate
14218	Takahashi et al., 2017	Y	N	N	N	N	Y	Y	Y	U	N	U	N	1	Low

QUASI EXPERIMENTAL STUDIES

	Author/year	Focussed question	Subjects and investigators blinded	Groups comparable at commencement	Only difference btw groups was treatment	Valid, reliable outcome measurement	Per cent drop out in study arms is reported and acceptable	Intention to treat analysis	Comparable results for multiple sites	Minimal bias	Reliable conclusions	Level of evidence	Quality
9515	Hao et al., 2015	Y	N	N	U	N	NA	Y	NA	Y	N	2	low

CASE SERIES

	Author/year	Focussed question	Participant characteristics reported	Inclusion criteria defined	Consecutive recruitment	Participants entered at same disease stage	Intervention clearly reported	Outcomes relevant and defined apriori	Valid, reliable outcome measurement	Per cent drop out reported and acceptable	Estimates of random variability	Comparable results for multiple sites	Minimal bias	Reliable conclusions	Level of evidence	Quality
9455	Sullivan, 2015	N	N	N	N	U	N	N	U	N	N	NA	N	N	4	Low
13935	Linthwaite & Bethell, 2016	Y	N	N	U	N	Y	Y	N	Y	N	N	N	N	4	Low
3169	Van Leen et al., 2014	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	4	Moderate

ECONOMIC EVALUATIONS

	Author/year	Focussed question	Economic importance of question is clear	Choice of study design is justified	All costs are included and measured and valued appropriately	Outcome measures to answer study question are relevant and measured and valued appropriately	Discounting of future costs and outcome measures is performed correctly when appropriate	Assumptions explicit and a sensitivity analysis conducted	Results provide information relevant for policy providers	Minimal bias	Reliable conclusions	Level of evidence	Quality
1476	A. Chuangsuwanich et al., 2013	Y	Y	Y	U	Y	U	N	Y	Y	U	NA	Moderate
16539	Lima et al., 2016	Y	Y	N	N	Y	NA	N	N	Y	Y	NA	Low
14427	Silva et al., 2017	Y	Y	N	Y	Y	NA	N	Y	Y	Y	NA	Moderate
13834	Souliotis et al., 2016	Y	Y	N	Y	Y	NA	N	N	N	N	NA	Low

SYSTEMATIC REVIEWS FOR DISCUSSION

RATING CRITERIA:

1 Partial yes: states review question, search strategy, in/exclusion criteria and risk of bias were a-priori; full yes: meta-analysis/synthesis plan, investigation of heterogeneity and justification for protocol deviation
2 Partial yes: At least 2 databases, provides keywords and search, justifies publication restrictions; full yes: searched reference lists of included studies, searched trial registries, consulted experts in field, searched grey literature, search within 24 months of review completion
3 At least two reviewers independently agreed on selection of studies to include or reviewers achieved 80% agreement on a sample of studies
4 Either two reviewers did data extraction and had >80% agreement, or two reviewers reached consensus on data to extract
5 Partial yes: list of all relevant studies that were read and excluded; full yes: every study that was excluded is independently justified
6 Partial yes: described populations, interventions, comparators, outcomes and research design; full yes: detailed descriptions of same plus study setting and timeframe for follow-up
7 FOR RCTS Partial yes: appraised risk of bias from unconcealed allocation and lack of blinding; full yes: appraised risk of bias on true randomisation, selection of reported result from multiple measurements/analyses
FOR non randomised studies: Partial yes: appraised confounding and selection bias; full yes: appraised methods to ascertain exposures and outcomes, selection of reported result from multiple measurements/analyses
8 Must include reporting of the source of funding of individual studies, or reports that the reviewers considered this even if individual funding sources aren't listed in review

Endnote ID	Author/year	PICO research question and inclusion criteria	Explicitly states a-priori protocol[1]	Rationale for selection of study designs	Comprehensive search[2]	Duplicate study selection[3]	Duplicate data extraction[4]	Excluded studies listed[5]	Adequate description of included studies[6]	Risk of bias assessed[7]	Source of funding reported[8]	Appropriate meta-analysis including weighting and adjustment for heterogeneity	Meta-analysis considers risk of bias of studies	Discussion consider risk of bias of studies	Assessment of publication bias if quantitative analysis is done	Potential conflicts of interest of authors reported and managed	Review Quality
10801	Dumville et al., 2015	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	NA	NA	Y	NA	Y	High
3043	Pott, Meier, Stocco, Crozeta, & Ribas, 2014				Y			Y		N		NA		N	NA		Exclude
9713	Zheng & Li, 2015				Y			N		N		Y		N	Y		Exclude
7844	Dumville Jo et al., 2014	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	NA	Y	NA	Y	High
1416	Han, Wang, Pu, & Shi, 2013				N			N		Y		Y		N	Y		Exclude
1644	Heyer et al., 2013				N			Y		N		Y		N	N		Exclude
14776	Walker et al., 2017	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	High
13947	Westby et al., 2017	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
9713	Zheng & Li, 2015				N			N		N		N		N	N		Exclude

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