

# Risk Assessment and Prevention of Pressure Ulcers: A Clinical Practice Guideline From the American College of Physicians

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**Description:** The American College of Physicians (ACP) developed this guideline to present the evidence and provide clinical recommendations based on the comparative effectiveness of risk assessment scales and preventive interventions for pressure ulcers.

**Methods:** This guideline is based on published literature on this topic that was identified by using MEDLINE (1946 through February 2014), CINAHL (1998 through February 2014), the Cochrane Library, clinical trials registries, and reference lists. Searches were limited to English-language publications. The outcomes evaluated for this guideline include pressure ulcer incidence and severity, resource use, diagnostic accuracy, measures of risk, and harms. This guideline grades the quality of evidence and strength of recommendations by using ACP's clinical practice guidelines grading system. The target audience for this guideline includes all clinicians, and the target patient population is patients at risk for pressure ulcers.

**Recommendation 1:** ACP recommends that clinicians should perform a risk assessment to identify patients who are at risk of developing pressure ulcers. (Grade: weak recommendation, low-quality evidence)

**Recommendation 2:** ACP recommends that clinicians should choose advanced static mattresses or advanced static overlays in patients who are at an increased risk of developing pressure ulcers. (Grade: strong recommendation, moderate-quality evidence)

**Recommendation 3:** ACP recommends against using alternating-air mattresses or alternating-air overlays in patients who are at an increased risk of developing pressure ulcers. (Grade: weak recommendation, moderate-quality evidence)

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**P**ressure ulcers are defined as localized injury to the skin and/or underlying tissue, usually over a bony prominence, as a result of pressure alone or in combination with shear (1). They commonly occur in patients with limited mobility, such as those in hospitals or long-term care settings. It is estimated that up to 3 million adults in the United States are affected by pressure ulcers (2). The prevalence in the United States is estimated to range from 0.4% to 38% in acute care hospitals, 2% to 24% in long-term care nursing facilities, and 0% to 17% in home care settings (2-4). Between 1990 and 2001, pressure ulcers were reported as a cause of death in nearly 115 000 persons and were listed as the underlying cause of death in more than 21 000 (5). The estimated cost of treating each case of pressure ulcers ranges from \$37 800 to \$70 000, and up to \$11 billion is spent annually in the United States to treat pressure ulcers (2, 6, 7). A growing industry has developed to market various products for pressure ulcer prevention.

Risk factors for pressure ulcers include older age; black race or Hispanic ethnicity; lower body weight; cognitive impairment; physical impairments; and other comorbid conditions that affect soft tissue integrity and healing, such as urinary or fecal incontinence, diabetes, edema, impaired microcirculation, hypoalbuminemia, and malnutrition (8-11). Various risk assessment instruments have been developed, including the Braden,

Cubbin and Jackson, Norton, Ramstadius, and Waterlow scales.

Prevention strategies for pressure ulcers begin with identification of high-risk persons. Many interventions designed to prevent pressure ulcers and reduce friction and shear are available, and categories include various support surfaces (such as mattresses, integrated bed systems, overlays, and cushions), repositioning, nutritional supplementation, skin care (for example, dressing and management of incontinence), and topical creams (Table 1). Studies have suggested that prevention of hospital-acquired pressure ulcers is more effective than standard care (12). Although this guideline focuses on a comparative effectiveness review of individual interventions, we understand that care teams often implement multicomponent interven-

**See also:**

Related articles . . . . .	370 and Ann Intern Med. 2013;159:28-38
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Supplement	

\* This paper, written by Amir Qaseem, MD, PhD, MHA; Tanveer P. Mir, MD; Melissa Starkey, PhD; and Thomas D. Denberg, MD, PhD, was developed for the Clinical Guidelines Committee of the American College of Physicians. Individuals who served on the Clinical Guidelines Committee from initiation of the project until its approval were Thomas D. Denberg, MD, PhD (*Chair*); Michael J. Barry, MD; Molly Cooke, MD; Paul Dallas, MD; Nick Fitterman, MD; Mary Ann Forciea, MD; Russell P. Harris, MD, MPH; Linda L. Humphrey, MD, MPH; Tanveer P. Mir, MD; Holger J. Schünemann, MD, PhD; J. Sanford Schwartz, MD; Paul Shekelle, MD, PhD; and Timothy Wilt, MD, MPH. Approved by the ACP Board of Regents on 26 July 2014.

**Table 1.** Pressure Ulcer Preventive Interventions

Intervention*	Description
Advanced static mattresses or overlays	Provide a constant level of inflation/ support and distribute body weight evenly
Alternating-air bed†	Changes the distribution of pressure by inflating or deflating cells within the mattress
Low-air-loss bed‡	Regulates heat and humidity by flowing air and, sometimes, pressure adjustments
Heel supports or boots	Support and cushion the heel, protecting against shear and distributing pressure evenly
Wheelchair cushions	Designed to distribute pressure evenly and provide added cushion support for patients who use wheelchairs
Nutritional supplementation	Addition of nutrients, such as protein, vitamins, and/or minerals, to diet to improve wound healing
Repositioning	Changes in body position to prevent constant contact with a surface
Silicone border foam dressing	Water-resistant dressing with nonexpanding foam to maintain a moist wound site for healing
Intraoperative warming	Application of warmth during surgery to prevent hypothermia
Creams and cleansers	Keep the skin clean and moisturized to prevent cracking

\* Brand-name products are listed as examples only and should not be considered endorsements from the American College of Physicians.

† Duo 2 (Hill-Rom), Lapidus Airfloat System (American Hospital Supply), MicroPulse, Trinova (Pegasus Healthcare), TriCell and AlphaXcell (ArjoHuntleigh Getinge Group), and Air Doctor.

‡ TheraPulse (KCI) and KinAir (ArjoHuntleigh Getinge Group).

tions or bundled approaches to preventing pressure ulcers and that pressure ulcer care involves physicians, nurses, and other members of the care team.

The purpose of this American College of Physicians (ACP) guideline is to present the available evidence on the comparative effectiveness of various risk assessment instruments and benefits and harms of strategies to prevent pressure ulcers. The target audience for this guideline is all clinicians, including physicians, nurses, dietitians, and physical therapists. The target patient population comprises all adults at risk for pressure ulcers. For recommendations on the treatment of pressure ulcers, please refer to the accompanying ACP guideline (13).

## METHODS

This guideline is based on a systematic evidence review (14), an update of the literature (Supplement, available at [www.annals.org](http://www.annals.org)), and an evidence report sponsored by the Agency for Healthcare Research and Quality (AHRQ) (17) that addressed the following key questions:

1. Is the use of risk assessment tools effective in reducing the incidence or severity of pressure ulcers, and how does effectiveness vary according to setting and patient characteristics?

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

3. In patients at increased risk for pressure ulcers, what is the effectiveness and comparative effectiveness

of preventive interventions in reducing the incidence or severity of pressure ulcers, and how does effectiveness vary according to assessed risk level, setting, or patient characteristics?

4. What are the harms of interventions for preventing pressure ulcers? Do harms differ according to the type of intervention, setting, or patient characteristics?

We searched MEDLINE (1946 through February 2014), CINAHL (1998 through February 2014), the Cochrane Library, clinical trials registries, and reference lists to identify trials published in English. The outcomes evaluated for this guideline include pressure ulcer incidence and severity; resource use (including duration of hospital stay or cost); diagnostic accuracy (sensitivity, specificity, and positive and negative likelihood ratios); measures of risk (hazard ratios, odds ratios, and relative risks); discrimination (area under the receiver-operating characteristic curve); and harms, such as dermatologic reactions, discomfort, and infection.

We also supplemented the AHRQ evidence review with another systematic evidence review of multicomponent strategies for preventing pressure ulcers that examined the importance of contextual aspects of programs that aim to reduce facility-acquired pressure ulcers (16). This review included implementation studies (from 2000 to September 2012) of multicomponent initiatives to prevent pressure ulcers in adults in U.S. acute and long-term care settings. Studies were limited to those that reported pressure ulcer rates at least 6 months after implementation of the intervention.

Further details about the methods and inclusion and exclusion criteria applied in the evidence review are available in the full AHRQ report (15) and the Supplement. This guideline rates the quality of evidence and strength of recommendations by using ACP's guideline grading system (Table 2). Details of the ACP guideline development process can be found in ACP's methods paper (17).

## COMPARATIVE EFFECTIVENESS OF RISK ASSESSMENT TOOLS FOR REDUCING THE INCIDENCE OR SEVERITY OF PRESSURE ULCERS

Low-quality evidence from 1 good-quality study showed no difference among the Waterlow scale, the Ramstadius tool (an unvalidated combination risk assessment and intervention protocol), and nurses' clinical judgment alone in reducing the risk for pressure ulcers or length of stay in patients (18). A recent Cochrane review supported this conclusion, citing lack of evidence to conclusively show a difference between the risk assessment tools and clinical judgment in reducing pressure ulcer incidence (19). No study evaluated the effectiveness of risk assessment tools across care settings or patient subgroups.

## COMPARATIVE DIAGNOSTIC ACCURACY OF RISK ASSESSMENT TOOLS FOR PREDICTING THE INCIDENCE OF PRESSURE ULCERS

Moderate-quality evidence showed that the Braden, Cubbin and Jackson, Norton, and Waterlow scales had low sensitivity and specificity to identify patients at risk for pressure ulcers. In addition, moderate-quality evidence showed that diagnostic accuracy did not differ substantially among the scales (15). Low-quality evidence showed no clear differences in diagnostic accuracy of the Braden scale according to patient characteristics or settings, with lower optimal cutoffs for surgical or acute care patients. Moderate-quality evidence showed no clear differences in diagnostic accuracy of the Braden scale according to baseline pressure ulcer risk. Although the Cubbin and Jackson scale was initially developed for patients in intensive care units, low-quality evidence showed that it had a similar diagnostic accuracy to the Braden and Waterlow scales in this setting (20, 21). **Tables 3 and 4** provide descriptions of the scales as well as sensitivities and specificities; more details are available in the full evidence report (15).

## EVIDENCE RELATED TO INDIVIDUAL INTERVENTIONS

### Effectiveness and Comparative Effectiveness of Preventive Interventions to Reduce the Incidence or Severity of Pressure Ulcers

Many interventions were studied by only 1 trial each, and pooling of studies was not practical because of methodological limitations and clinical diversity of the studies. **Table 5** summarizes the evidence for the various preventive interventions. Static (moderate-quality evidence) (55-59) and alternating-air (low-quality evidence) (74-76) mattresses or overlays reduced pressure ulcer incidence compared with standard hospital mattresses. Evidence was mixed or showed no statistically significant difference for comparisons of other support surfaces (61-69, 71-83). Low-quality evidence showed no difference in risk for pressure ulcers or mixed results for heel supports or boots

**Table 2.** The American College of Physicians' Guideline Grading System\*

Quality of Evidence	Strength of Recommendation	
	Benefits Clearly Outweigh Risks and Burden or Risks and Burden Clearly Outweigh Benefits	Benefits Finely Balanced With Risks and Burden
High	Strong	Weak
Moderate	Strong	Weak
Low	Strong	Weak
Insufficient evidence to determine net benefits or risks		

\* Adopted from the classification developed by the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) workgroup.

(84, 85), different wheelchair cushions (86-89), nutritional supplementation (90-95), various dressings (101, 102), intraoperative warming (103), and various repositioning intervals (low- to moderate-quality evidence) (96-100, 108, 109). Low-quality evidence showed that a skin cream containing fatty acid and a skin cleanser other than soap decreased risk for pressure ulcers (60, 110, 111).

### Harms of Interventions to Prevent Pressure Ulcers

A total of 16 trials reported harms for interventions to prevent pressure ulcers. Although details on specific harms were sparse, no serious treatment-related harms were reported. In summary, evidence was insufficient to determine how harms of preventive interventions vary according to the type of intervention, care setting, or patient characteristics.

### Mattresses, Overlays, and Other Support Systems

Low-quality evidence from 9 studies of support surfaces reported harms. Heat-related discomfort was reported in 3 trials of sheepskin overlays, which also led to withdrawals (56, 57, 60). One trial reported differences in pain and sleep disturbances between different dynamic mattresses (110). A study comparing a multi-cell pulsating dynamic mattress with a static gel overlay found no differences in risk for adverse events (111).

**Table 3.** Descriptions of Commonly Used Pressure Ulcer Risk Assessment Tools\*

Tool	Population	Subscales	Scoring
Braden scale	General	Mobility, activity, sensory perception, skin moisture, nutrition state, and friction/shear	Scale of 6 to 23; lower score indicates higher risk
Cubbin and Jackson scale	Intensive care unit patients	Age, weight, medical history, skin condition, mental state, mobility, nutrition, respiration, incontinence, hygiene, hemodynamic state, oxygen requirements, use of blood products, surgery within 24 h, and hypothermia	Scale of 9 to 48; lower score indicates higher risk
Norton scale	General	Physical condition, mental state, activity, mobility, and incontinence	Scale of 5 to 20; lower score indicates higher risk
Waterlow scale	General	Build/weight for height, skin condition, sex and age, continence, mobility, appetite, medication, and other risk factors (tissue malnutrition, neurologic deficit, and major surgery or trauma)	Scale of 1 to 64; higher score indicates higher risk

\* Adapted from reference 15.

**Table 4. Evidence for Pressure Ulcer Risk Assessment Tools\***

Characteristic	Quality of Evidence	Data
<b>Braden scale</b>		
Overall diagnostic accuracy	Moderate	Median sensitivity, 0.74 (range, 0.33 to 1.00); median specificity, 0.68 (range, 0.34 to 0.86) (cutoff, ≤18); 1 poor-quality, 7 fair-quality, and 8 good-quality studies (22-37)
Across settings	Low	No clear differences across settings (cutoff, ≤15 to 18); 10 good-quality, 16 fair-quality, and 2 poor-quality studies (21-36, 38-49)
Optimal cutoff in different settings	Low	Lower optimal cutoff in acute care setting (sensitivity, 0.55; specificity, 0.94) (cutoff, ≤15) compared with long-term care setting (sensitivity, 0.57; specificity, 0.61) (cutoff, ≤18); statistical significance not reported; 1 good-quality study (30) Lower optimal cutoff in surgical patients (cutoff, ≤13 to 14) compared with other settings (cutoff, ≤15 to ≤18); 1 good-quality and 1 fair-quality study (31, 44)
Differences according to race	Low	No clear differences between black and white patients; 1 fair-quality study (50)
Differences according to baseline pressure ulcer risk	Moderate	No clear differences; 1 good-quality and 2 fair-quality studies (20, 27, 37)
<b>Cubbin and Jackson scale</b>		
Overall diagnostic accuracy	Moderate	Median sensitivity, 0.89 (range, 0.83 to 0.95); median specificity, 0.61 (range, 0.42 to 0.82) (cutoff, ≤24 to 29); 1 good-quality and 2 fair-quality studies (20, 21, 44)
Intensive care unit setting	Low	Similar diagnostic accuracy in intensive care unit patients compared with Braden and Waterlow scales; 1 good-quality and 1 fair-quality study (20, 21)
<b>Norton scale</b>		
Diagnostic accuracy	Moderate	Median sensitivity, 0.75 (range, 0.00 to 0.89); median specificity, 0.68 (range, 0.59 to 0.95) (cutoff, ≤14); 1 good-quality and 4 fair-quality studies (27, 45, 51-53)
<b>Waterlow scale</b>		
Pressure ulcer incidence or severity (vs. clinical judgment)	Low	No difference compared with nurses' clinical judgment alone: RR, 1.40 (95% CI, 0.82 to 2.40); 1 good-quality study (18)
Diagnostic accuracy	Moderate	Sensitivities, 0.88 and 1.00; specificities, 0.13 and 0.29 (cutoff, ≥10); 2 fair-quality studies (20, 53)
<b>Diagnostic accuracy: direct comparisons among risk assessment scales</b>	Moderate	No clear differences among scales; 2 good-quality and 4 fair-quality studies (20, 21, 27, 37, 44, 54)

RR = relative risk.

\* Adapted from reference 15.

One study reported no increased risk for adverse events with the Heelift Suspension Boot (DM Systems) compared with standard care (84). One study reported an increased risk for withdrawal due to discomfort with the Jay cushion compared with standard wheelchair cushions (88).

**Nutritional Supplementation**

Low-quality evidence from 1 study reported that tube feeds were poorly tolerated (54% removed within 1 week and 67% removed within 2 weeks) (93).

**Repositioning**

Low-quality evidence from 2 studies reported increased nonadherence due to intolerability of repositioning at a 30-degree tilt position compared with standard positioning (108, 109).

**Dressings**

Low-quality evidence from 1 study showed that application of the Remois Pad (Alcare) resulted in pruritus in 1 patient out of 37 total (112).

**Creams, Lotions, and Cleansers**

Low-quality evidence from 3 studies reported harms for lotions or creams. Two studies reported 1

case each of a wet sore or rash, and 1 study showed no differences in rash between various creams studied (106, 113, 114).

**INTERVENTIONS TO FACILITATE IMPLEMENTATION OF PRESSURE ULCER PREVENTION PROTOCOLS OR GUIDELINES**

Low-quality evidence from 1 study showed no difference in incident stage 2 to 4 ulcers between a multicomponent electronic clinical decision-support system or provision of guidelines (1.8% vs. 2.1%; relative risk, 0.85 [95% CI, 0.23 to 3.10]) (107). Evidence from 1 poor-quality study showed that immediate implementation of musical cues was associated with lower risk for incident ulcers in nursing home residents (6.0% vs. 9.4%; relative risk, 0.64 [CI, 0.45 to 0.90]) (115).

**EVIDENCE RELATED TO MULTICOMPONENT INTERVENTIONS**

Multicomponent interventions are increasingly becoming the standard of care for prevention of pressure ulcers. Bundling care practices and organizing a team

**Table 5.** Evidence for Interventions to Reduce Incidence and Severity of Pressure Ulcers

Intervention	Quality of Evidence	Effect on Reduction in Incidence and Severity*	Data
<b>Mattresses, overlays, or other support systems</b>			
Static mattress or overlay vs. standard hospital mattress	Moderate	Improved	Reduced ulcer risk: RR range, 0.16 to 0.82; 1 good-quality and 4 fair-quality studies (55-59) Australian medical sheepskin overlay subgroup analysis: RRs, 0.30, 0.58, and 0.58; 2 fair-quality and 1 poor-quality studies (56, 57, 60)
Static mattress or overlay vs. static mattress or overlay	Moderate	Mixed results	3 fair-quality and 6 poor-quality studies showed no differences (61-69) 1 fair-quality study showed that a foam replaceable-parts mattress was associated with lower risk for ulcers than a 4-in-thick, dimpled foam overlay (25% vs. 60%; RR, 0.42 [95% CI, 0.18 to 0.96]) (70)
Low-air-loss bed vs. standard hospital mattress	Low	Mixed results	Lower risk for $\geq 1$ pressure ulcer in intensive care unit patients (12% vs. 51%; RR, 0.23 [CI, 0.10 to 0.51]); 1 fair-quality study (71) No differences in cardiovascular surgery patients; 1 poor-quality study (73)
Low-air-loss mattress vs. dual-option (constant low pressure/alternating-air) mattress	Low	No difference	No statistically significant difference in pressure ulcer risk (10% vs. 19%; RR, 0.53 [CI, 0.15 to 1.90]); 1 fair-quality study (73)
Alternating-air overlay or mattress vs. standard hospital mattress	Low	Improved	Lower incidence of pressure ulcers; 3 poor-quality studies (74-76)
Alternating-air overlay or mattress vs. advanced static overlay or mattress	Moderate	No difference	No difference in pressure ulcer incidence or severity; 1 good-quality, 1 fair-quality, and 4 poor-quality studies (68, 74, 75, 77-79)
Alternating-air overlay or mattress vs. alternating-air overlay or mattress	Moderate	No difference	No clear differences among various alternating-air mattresses or overlays; 1 good-quality, 2 fair-quality, and 1 poor-quality studies (76, 80-83)
Heel supports or boots vs. usual care	Low	Mixed results	Decreased risk for heel, foot, or ankle ulcers with Heelift Suspension Boot (DM Systems) compared with usual care without leg elevation in fracture patients for any ulcer (7% vs. 26%; RR, 0.26 [CI, 0.12 to 0.53]) and for stage 2 ulcers (3.3% vs. 13.4%; RR, 0.25 [CI, 0.09 to 0.72]); 1 fair-quality study (84) No difference in risk for ulcers between Foot WAFFLE (EHOB) boot and hospital pillow to prop up legs; 1 poor-quality study (85)
More sophisticated wheelchair cushions vs. standard wheelchair cushions	Low	Mixed results	Inconsistent results from 4 fair-quality studies assessing different cushions (86-89)
<b>Nutritional supplementation vs. standard hospital diet</b>	Low	No difference	No difference overall in pressure ulcer risk with oral or enteral supplementation (5 of 6 studies showed no difference); 1 fair-quality and 5 poor-quality studies (90-95)
<b>Repositioning</b>			
Repositioning intervention vs. usual care	Moderate	Mixed results	Lower risk for pressure ulcers with repositioning at a 30-degree tilt every 3 h compared with usual care (3.0% vs. 11.0%; RR, 0.27 [CI, 0.08 to 0.93]); 1 fair-quality study (96) No difference in risk for stage 2 to 4 ulcers among repositioning every 2, 3, or 4 h (2.5% vs. 0.6% vs. 3.0%, respectively [ $P = 0.68$ ]); 1 good-quality study (97) No difference in risk for pressure ulcers among various repositioning intervals; 1 fair-quality study (98)
Small unscheduled shifts in body position vs. usual care	Low	No difference	No difference in pressure ulcer risk, but only 1 or 2 ulcers were reported in each study; 2 poor-quality studies (99, 100)
<b>Dressings</b>			
Silicone border foam sacral dressing vs. no silicone border foam dressing	Low	No difference	No statistically significant difference in pressure ulcer risk in cardiac surgery patients (2.0% vs. 12.0%; RR, 0.18 [CI, 0.02 to 1.50]); 1 fair-quality study (101)
Changing incontinence pad 3 vs. 2 times per day	Low	No difference	No difference in pressure ulcer risk; 1 fair-quality study (102)
Intraoperative warming vs. usual care	Low	No difference	No difference in pressure ulcer risk in surgical patients (5.6% vs. 10.0%; RR, 0.54 [CI, 0.25 to 1.20]); 1 fair-quality study (103)
<b>Creams, lotions, and cleansers</b>			
Fatty acid cream vs. placebo	Low	Improved	Reduced risk for new pressure ulcers with Mepentol (BAMA-GEVE) lotion (7.3% vs. 17%; RR, 0.42 [CI, 0.22 to 0.80]); 1 fair-quality study (104) Lotion containing 1.6 g of fatty acid: 4.7% vs. 28.0%; RR, 0.17 [CI, 0.04 to 0.70]; 1 poor-quality study (105)
Skin cleanser (Clinisan [Synergy Health]) vs. standard soap and water	Low	Improved	Reduced risk for pressure ulcers in patients with incontinence at baseline (18% vs. 42%; RR, 0.43 [CI, 0.19 to 0.98]); 1 fair-quality study (106)

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Table 5—Continued

Intervention	Quality of Evidence	Effect on Reduction in Incidence and Severity*	Data
<b>Interventions to facilitate implementation of pressure ulcer prevention protocols or guidelines</b>			
Multicomponent electronic clinical decision-support system vs. provision of guideline	Low	No difference	No difference in incident stage 2 to 4 ulcers in 1 fair-quality study (1.8% vs. 2.1%; RR, 0.85 [CI, 0.23 to 3.10]) (107)

RR = relative risk.

\*“Improved” denotes that the intervention provided benefit compared with control. “No difference” indicates that the intervention was similar to control. “Mixed results” denotes inconsistent results for different outcomes.

approach to care have been shown to be effective at improving patient outcomes.

**Benefits**

Moderate-quality evidence from a review of 26 implementation studies showed that multicomponent interventions can improve skin care and reduce pressure ulcer rates in both acute and long-term care settings (16). The review found that key components of successful interventions include simplification and standardization of pressure ulcer-specific interventions and documentation, involvement of multidisciplinary teams and leadership (including ostomy, continence, and other nurses and personnel), designated skin champions who educate staff about skin care and ulcer prevention, ongoing staff education (including team meetings and motivational campaigns), and sustained audit and feedback (including weekly prevalence reports, formal and informal feedback, and all-facility meetings) (16). Successful interventions also incorporated evidence-based guidelines into their practices.

**Harms**

The systematic review found no harms reported for the multicomponent strategies that were used to prevent pressure ulcers (16).

**Costs**

The systematic review identified 4 studies (116-120) that reported significant cost savings with the multicomponent approach. In 2008, a 2-hospital system (548 beds in Naples, Florida) estimated annual cost savings of approximately \$11.5 million as a result of statistically significant reductions in pressure ulcer prevalence (117).

**SUMMARY**

Low-quality evidence showed that risk assessment tools (the Waterlow and Ramstadius scales) were equivalent to clinical judgment alone for reducing pressure ulcer incidence. Evidence on the diagnostic accuracy of the commonly used risk assessment instruments showed that these tools can help in the identification of patients who are at an increased risk for pressure ulcers, although the sensitivities and specificities were low. Diagnostic accuracy did not differ substantially among the various risk assessment instruments, and studies of direct comparisons were limited.

Most of the evidence on preventive interventions came from studies assessing support surfaces. Moderate-quality evidence showed that advanced static mattresses and overlays were associated with a lower risk for pressure ulcers compared with standard mattresses in higher-risk patients. Evidence on other preventive interventions, including nutritional supplementation, lotions, cleansers, and dressings, was limited and inconclusive because most were assessed by few studies.

Little evidence was available on harms of preventive interventions, although no serious harms were reported. Evidence was also insufficient to draw a conclusion about harms based on the type of intervention, care setting, or patient characteristics.

All of the preventive interventions reviewed in this guideline were assessed individually, but they can be bundled to provide optimum care. Evidence shows that multicomponent strategies can improve clinical outcomes. Key components of successful implementation efforts include simplification and standardization of pressure ulcer-specific interventions and documentation, involvement of multidisciplinary teams and leadership, designated skin champions, ongoing staff education, and sustained audit and feedback. The Figure summarizes the recommendations and clinical considerations.

**RECOMMENDATIONS**

*Recommendation 1: ACP recommends that clinicians should perform a risk assessment to identify patients who are at risk of developing pressure ulcers. (Grade: weak recommendation, low-quality evidence)*

Risk assessment is often part of bundled care and multicomponent interventions for preventing pressure ulcers. Risk factors for pressure ulcers include older age; black race or Hispanic ethnicity; lower body weight; cognitive impairment; physical impairments; and other comorbid conditions that affect soft tissue integrity and healing, such as urinary or fecal incontinence, diabetes, edema, impaired microcirculation, hypoalbuminemia, and malnutrition. Clinicians should make individualized decisions based on risk assessment on whether to use a single or multicomponent intervention to prevent pressure ulcers in patients.

**Figure.** Summary of the American College of Physicians guideline on risk assessment and prevention of pressure ulcers.

### SUMMARY OF THE AMERICAN COLLEGE OF PHYSICIANS GUIDELINE ON RISK ASSESSMENT AND PREVENTION OF PRESSURE ULCERS

Disease/Condition	Pressure ulcers
Target Audience	Internists, family physicians, and other clinicians
Target Patient Population	Patients at risk for pressure ulcers
Interventions Evaluated	<p>Risk assessment tools:</p> <ul style="list-style-type: none"> <li>Braden scale</li> <li>Cubbin and Jackson scale</li> <li>Norton scale</li> <li>Waterlow score</li> </ul> <p>Preventive interventions:</p> <ul style="list-style-type: none"> <li>Mattresses and overlays</li> <li>Heel supports</li> <li>Wheelchair cushions</li> <li>Nutritional supplementation</li> <li>Lotions, creams, and cleansers</li> <li>Repositioning</li> <li>Dressings</li> </ul>
Outcomes Evaluated	Pressure ulcer incidence and severity, resource use, diagnostic accuracy, measures of risk, and harms
Benefits	<p>Risk assessment instruments: prediction of patients at high risk for pressure ulcers</p> <p>Preventive interventions: reduced pressure ulcer incidence and severity</p>
Harms	<p>Mattresses, overlays, and other support systems: discomfort</p> <p>Nutritional supplementation: poorly tolerated tube feeds</p> <p>Repositioning: intolerability of repositioning at a 30-degree tilt position</p> <p>Dressings: pruritus</p> <p>Creams or lotions: wet sore or rash</p>
Recommendations	<p><i>Recommendation 1: ACP recommends that clinicians should perform a risk assessment to identify patients who are at risk of developing pressure ulcers. (Grade: weak recommendation, low-quality evidence)</i></p> <p><i>Recommendation 2: ACP recommends that clinicians should choose advanced static mattresses or advanced static overlays in patients who are at an increased risk of developing pressure ulcers. (Grade: strong recommendation, moderate-quality evidence)</i></p> <p><i>Recommendation 3: ACP recommends against using alternating-air mattresses or alternating-air overlays in patients who are at an increased risk of developing pressure ulcers. (Grade: weak recommendation, moderate-quality evidence)</i></p>
Inconclusive Areas of Evidence	Evidence is insufficient to compare various preventive interventions, such as different types of repositioning and leg elevations, relative to various kinds of usual care. Creams and lotions, dressings, repositioning, and nutritional support, in any combination, are generally regarded as usual care.
High-Value Care	Many hospitals in the United States use alternating-air and low-air-loss mattresses and overlays despite the lack of evidence showing a potential benefit in the reduction of pressure ulcers in high-risk populations. Using these support systems is expensive and adds unnecessary burden on the health care system. On the basis of the review of current evidence, lower-cost support services should be the preferred approach to care.
Clinical Considerations	<p>Identification of high-risk patients is important to prevent pressure ulcers.</p> <p>Prevention of pressure ulcers requires regular monitoring, and patients should be reassessed periodically for any change in status.</p> <p>Pressure relief is an important variable in the prevention of pressure ulcers.</p> <p>The choice of preventive strategies should be based on risk factors and the costs and availability of resources.</p> <p>Individual preventive strategies can be combined in multicomponent interventions</p>

The current evidence does not conclusively show a difference between clinical judgment and risk assessment scales in reducing pressure ulcer incidence. However, tools may be especially useful for clinicians without expert gestalt. Moderate-quality evidence showed that the Braden, Cubbin and Jackson, Norton, and Waterlow scales can predict which patients are more likely to develop a pressure ulcer, and all of these instruments have low sensitivity and specificity. In addition, moderate-quality evidence showed that the diagnostic accuracies of the scales do not differ substantially. No

study evaluated the effectiveness of risk assessment tools across care settings or patient subgroups.

*Recommendation 2: ACP recommends that clinicians should choose advanced static mattresses or advanced static overlays in patients who are at an increased risk of developing pressure ulcers. (Grade: strong recommendation, moderate-quality evidence)*

Moderate-quality evidence showed that the use of advanced static mattresses or overlays was associated with a lower risk for pressure ulcers compared with standard hospital mattresses, and no brand was shown

to be superior. Advanced static mattresses and overlays are also less expensive than alternating-air or low-air-loss mattresses and can be used as part of a multi-component approach to pressure ulcer prevention.

*Recommendation 3: ACP recommends against using alternating-air mattresses or alternating-air overlays in patients who are at an increased risk of developing pressure ulcers. (Grade: weak recommendation, moderate-quality evidence)*

The current evidence does not show a clear benefit for pressure ulcer prevention using alternating-air beds and overlays compared with static mattresses and overlays, and alternating-air beds and overlays are associated with significantly higher costs. Lower-cost support surfaces should be the preferred approach to care.

## INCONCLUSIVE AREAS OF EVIDENCE

Evidence is insufficient to compare various preventive interventions, such as different types of repositioning and leg elevations, relative to various kinds of usual care. Creams and lotions, dressings, repositioning, and nutritional support, in any combination, are generally regarded as usual care. Of note, the comparison group in many studies was standard care that often included repositioning, skin care, and/or nutrition. Therefore, any lack of evidence showing benefit relative to the comparison group of usual care does not mean that usual care should be abandoned.

## FUTURE RESEARCH

Data on the efficacy of many of the interventions came only from single studies, and further research into comparative effectiveness of pressure ulcer prevention strategies is warranted. In addition, more research is needed on the comparative efficacy of pressure ulcer risk assessment tools and their efficacy compared with clinical judgment.

## HIGH-VALUE CARE

Prevention of pressure ulcers is the first important step, and advanced static mattresses and overlays were associated with a lower risk for pressure ulcers compared with standard mattresses in higher-risk patients. Many hospitals in the United States use alternating-air and low-air-loss mattresses and overlays despite the lack of evidence showing a potential benefit in the reduction of pressure ulcers in high-risk populations. Using these support systems is expensive and adds unnecessary burden on the health care system. Based on the review of the current evidence, lower-cost support services should be the preferred approach to care.

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**Note:** Clinical practice guidelines are "guides" only and may not apply to all patients and all clinical situations. Thus, they are not intended to override clinicians' judgment. All ACP

clinical practice guidelines are considered automatically withdrawn or invalid 5 years after publication or once an update has been issued.

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