Pressure ulcer risk assessment and prevention: comparative effectiveness
Chou R, Dana T, Bougatsos C, Blazina I, Starmer A, Reitel K, Buckley D

CRD summary
This generally well-conducted review concluded that commonly used instruments can predict which patients are more likely to develop a pressure ulcer. There were no clear differences in test accuracy between methods. Advanced static support surfaces were more effective than standard mattresses for reducing risk of pressure ulcers. The review conclusions seem appropriate.

Authors' objectives
To evaluate the predictive ability of pressure ulcer risk assessment tools and the benefits and harms of interventions to prevent and treat pressure ulcers.

Searching
MEDLINE, CINAHL and Cochrane Database of Systematic Reviews were searched to July 2012 for studies in English; full search strategies were reported. Reference lists of relevant studies were searched. Scientific information packets were requested from drug and device manufacturers of pressure ulcer treatments; unpublished data could be submitted at the same time.

Study selection
Inclusion criteria were developed for four key questions: effectiveness of risk assessment tools; comparison of risk assessment tools; effectiveness of preventive interventions; and harms of preventive interventions.

Effectiveness/comparison of risk assessment tools: Eligible studies were controlled clinical trials or cohort studies of effectiveness or prospective studies of comparisons of risk assessment tools. Participants needed to be adults; up to 10% could have pressure ulcers at baseline. Studies of effectiveness needed to compare use of a risk assessment instrument to another risk assessment instrument or clinical judgment. Comparison studies needed to report accuracy of validated risk assessment tools for predicting incident pressure ulcers.

Effectiveness and harms of preventive interventions: Eligible studies were controlled clinical trials of effectiveness or cohort studies of harms. Participants needed to be adults; up to 20% could have stage 2 or higher pressure ulcers at baseline. Studies needed to compare interventions for prevention of pressure ulcers to usual care, no treatment or another preventive intervention.

Outcomes of interest were pressure ulcer incidence and severity, resource utilisation, predictive validity, diagnostic accuracy, risk and harms.

Where reported, the mean age of participants ranged from 32 to 85 years and from 28% to 85% were women. Prevalence of pressure ulcers in the intervention studies ranged from 1% to 74%.

Two reviewers selected studies for the review; discrepancies were resolved through discussion and consensus or referral to a third reviewer.

Assessment of study quality
Study quality was assessed using either an 11-point tool from US Preventative Services Task Force criteria for controlled trials, a modified eight-point Downs and Black questionnaire for cohort studies or an eight-point version of QUADAS 2 for test accuracy studies. Generalisability of the studies to populations likely to be targeted by screening was assessed. The overall strength of evidence was assessed using the Agency for Healthcare Research and Quality (AHRQ) methods guide for comparative effectiveness reviews.

Two reviewers independently assessed study quality; disagreements were resolved by discussion or referral to a third reviewer.
Data extraction
Data were extracted to calculate relative risks (RR), odds ratios, hazards ratios or the area under the curve (AUC) from summary receiver operating characteristic (SROC) curves, with 95% confidence intervals (CI) where appropriate. Cut-offs assigned for risk assessment instruments were: Braden scale ≤15 to 18; Norton scale <12 to 16; Waterlow scale ≥10 to 15; and Cubbin and Jackson scale ≤29.

Methods of synthesis
Studies were combined in a narrative synthesis; differences between studies were discussed in the text and study details and results were tabulated. Median sensitivity and specificity and AUC, and associated ranges, were reported for test accuracy. Positive and negative likelihood ratios were calculated from median sensitivities and specificities.

Results of the review
One hundred and twenty studies met the inclusion criteria for the review.

Effectiveness of risk assessment tools: In terms of pressure ulcer development, good quality RCTs showed no difference between clinical judgement and the Waterlow scale (RR 1.4, 95% CI 0.82 to 2.4) or the Ramstadius tool (RR 0.77, 95% CI, 0.44 to 1.4). The modified Norton scale was associated with lower risk of pressure ulcers compared with clinical judgment in one poor quality trial (RR 0.11, 95% CI, 0.03 to 0.46; one RCT) but no difference between the Braden scale and clinical judgment in a second poor quality trial. The strength of evidence was considered insufficient.

Comparison of risk assessment tools: The median AUC was 0.77 (range 0.55 to 0.88; seven studies) for the Braden scale, 0.74 (range 0.56 to 0.75; three studies) for the Norton scale, 0.61 (range 0.54 to 0.66; four studies) for the Waterlow scale and 0.83 (range 0.72 to 0.90; three studies) for the Cubbin and Jackson scale. There was no clear difference across instruments in six studies of direct comparisons. The strength of evidence was considered moderate.

Effectiveness of preventive interventions: Static mattresses and overlays were consistently found to lower the risk of developing pressure ulcers compared with standard mattresses in good and fair quality randomised trials in high risk populations (range of RR 0.16 to 0.82; five studies). Most trials (20 out of 25 comparisons) showed no differences between alternating air mattresses and low air loss mattresses and various static mattresses and overlays. The strength of evidence was considered insufficient to moderate.

Harms of preventive interventions: No studies evaluated harms directly. Reported harms were too limited for assessment.

Results for a wide range of interventions other than mattresses that were assessed in individual or poor quality studies were also reported, as were results for studies reporting differences across settings and/or patient characteristics for each review question.

Authors’ conclusions
Studies suggested that commonly used instruments can predict which patients are more likely to develop an ulcer. There were no clear differences in test accuracy. Evidence suggested that more advanced static support surfaces were more effective than standard mattresses for reducing risk of pressure ulcers but it would be inappropriate to conclude that standard repositioning, skin care, nutrition and other practices should be abandoned as these were the basis of usual-care comparisons.

CRD commentary
The review addressed clear research questions supported by reproducible inclusion criteria. Appropriate sources were searched. Only studies published in English were included. Searches for studies of test accuracy used accuracy filters so relevant studies may have been missed. Each stage of the review process was conducted in duplicate which reduced potential for error and bias.

The choice to combine studies in a narrative synthesis was appropriate for some of the questions but the usefulness of median sensitivities and specificities was limited and calculation of likelihood ratios from these medians was questionable.
This generally well-conducted review included a large number of studies and the conclusions seem appropriate.

**Implications of the review for practice and research**

**Practice**: The authors stated that decisions about whether to use risk-assessment instruments and which risk-assessment instrument to use may depend on considerations such as a desire to standardise and monitor practices within a clinical setting, ease of use and nursing or other caregiver preferences.

**Research**: The authors stated that more evidence was needed to understand the effectiveness and comparative effectiveness of dynamic and other support surfaces. The cost-effectiveness of advanced static support surfaces needed investigation. Other future research needs were: effectiveness of standardised risk-assessment instruments compared with clinical judgment or non-standardised use in preventing pressure ulcers; head-to-head comparisons of test accuracy; and effectiveness of preventive interventions.

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the reliability of the review and the conclusions drawn.