
PURPOSE:
Clinical practice guidelines on pressure ulcer (PU) prevention have been written primarily for inpatient settings, but we currently lack data as to how these guidelines have been adapted for use in home health care. The purpose of this study was to delineate interventions and activities used to prevent PU in home health care.

DESIGN:
Focus group study using text analysis.

SUBJECTS:
A focus group was conducted with 9 certified wound care nurses who practiced in home health care at least 50% of the time. Most of the participants had 10 or more years of home health experience and 5 or more years of wound care experience.

METHODS: The single 75-minute focus group was convened by teleconference and audiotaped. A semistructured moderator's guide was used to lead the discussion. Transcribed data were analyzed using standard text analysis. Preliminary results were distributed to focus group participants for review, comment, or clarification, and refined as needed.

RESULTS: Certified wound care nurse participants used an array of interventions, including those recommended by clinical practice guidelines, to prevent PU in home health patients. However, specific activities differed from those performed in hospitals and nursing homes. Interventions unique to home health care included (1) assessment of patients' economic and insured status to determine implementation options, (2) assessment of caregiving resources and caregivers' ability to manage PU prevention, and (3) collaboration with community resources and healthcare vendors to obtain needed prevention materials and supplies.

CONCLUSION: Findings provide insight into guideline adaptation in home health care and suggest that PU prevention in the home health care setting is more complex than that in hospitals and nursing homes and requires significant skills in communication and collaboration.
Niederhauser A, VanDeusen Lukas C, Parker V, Ayello EA, Zulkowski K, Berlowitz D.


OBJECTIVE: The objective of this study was to examine the evidence supporting the combined use of interventions to prevent pressure ulcers (PrUs) in acute care and long-term-care facilities.
DESIGN: A systematic review of the literature describing multifaceted PrU prevention programs was performed. Articles were included if they described an intervention implemented in acute care settings or long-term-care facilities, incorporated more than 1 intervention component, involved a multidisciplinary team, and included information about outcomes related to the intervention.
MAIN RESULTS: Twenty-four studies were identified. Recurring components used in the development and implementation of PrU prevention programs included preparations prior to the start of a program, PrU prevention best practices, staff education, clinical monitoring and feedback, skin care champions, and cues to action. Ten studies reported PrU prevalence rates; 9 of them reported decreased prevalence rates at the end of their programs. Of the 6 studies reporting PrU incidence rates, 5 reported a decrease in incidence rates. Four studies measured care processes: 1 study reported an overall improvement; 2 studies reported improvement on some, but not all, measures; and 1 study reported no change.
CONCLUSIONS: There is a growing literature describing multipronged, multidisciplinary interventions to prevent PrUs in acute care settings and long-term-care facilities. Outcomes reported in these studies suggest that such programs can be successful in reducing PrU prevalence or incidence rates. However, to strengthen the level of evidence, sites should be encouraged to rigorously evaluate their programs and to publish their results.
PMID: 22441049 DOI: 10.1097/01.ASW.0000413598.97566.d7

BACKGROUND: The scientific knowledge about pressure ulcers (PUs) is growing, but there is a shortage of studies of PUs at end of life. The recommendations regarding PU prevention in palliative care (PC) are based on consensus documents.

AIM: To use data from a national register to identify predictors for development of PUs at the end of life.

DESIGN: A retrospective, descriptive, and comparative study design was used.

SETTING/PARTICIPANTS: All deceased patients over 17 years old (n = 60,319) and registered in the Swedish Register of Palliative Care (SRPC) during 2014 were included.

STATISTICAL ANALYSIS: Logistic regression.

RESULTS: In the full model, all health units except general palliative home care had a significantly higher incidence of PUs than did the nursing homes. The well-known predictors of PUs in general, diabetes, postfracture state, infections, and multiple sicknesses, are predictors even in dying patients. Dementia was significantly associated with lower likelihood of PUs, while pain was associated with more PUs. Intravenous drip or enteral feeding was associated with a significantly decreased likelihood of developing PUs.

CONCLUSIONS: The SRPC could be a unique resource for quality improvement and research. The present study cannot prove causation, but it can report correlations between background variables and PU prevalence. More studies, with different designs, are warranted to establish the roles of risk factors for PU in end-of-life care.

BACKGROUND: Pressure ulcers (i.e. bedsores, pressure sores, pressure injuries, decubitus ulcers) are areas of localised damage to the skin and underlying tissue. They are common in the elderly and immobile, and costly in financial and human terms. Pressure-relieving support surfaces (i.e. beds, mattresses, seat cushions etc) are used to help prevent ulcer development.

OBJECTIVES: This systematic review seeks to establish:(1) the extent to which pressure-relieving support surfaces reduce the incidence of pressure ulcers compared with standard support surfaces, and,(2) their comparative effectiveness in ulcer prevention.

SEARCH METHODS: In April 2015, for this fourth update we searched The Cochrane Wounds Group Specialised Register (searched 15 April 2015) which includes the results of regular searches of MEDLINE, EMBASE and CINAHL and The Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2015, Issue 3).

SELECTION CRITERIA: Randomised controlled trials (RCTs) and quasi-randomised trials, published or unpublished, that assessed the effects of any support surface for prevention of pressure ulcers, in any patient group or setting which measured pressure ulcer incidence. Trials reporting only proxy outcomes (e.g. interface pressure) were excluded. Two review authors independently selected trials.

DATA COLLECTION AND ANALYSIS: Data were extracted by one review author and checked by another. Where appropriate, estimates from similar trials were pooled for meta-analysis.

MAIN RESULTS: For this fourth update six new trials were included, bringing the total of included trials to 59. Foam alternatives to standard hospital foam mattresses reduce the incidence of pressure ulcers in people at risk (RR 0.40 95% CI 0.21 to 0.74). The relative merits of alternating- and constant low-pressure devices are unclear. One high-quality trial suggested that alternating-pressure mattresses may be more cost effective than alternating-pressure overlays in a UK context. Pressure-relieving overlays on the operating table reduce postoperative pressure ulcer incidence, although two trials indicated that foam overlays caused adverse skin changes. Meta-analysis of three trials suggest that Australian standard medical sheepskins prevent pressure ulcers (RR 0.56 95% CI 0.32 to 0.97).

AUTHORS’ CONCLUSIONS: People at high risk of developing pressure ulcers should use higher-specification foam mattresses rather than standard hospital foam mattresses. The relative merits of higher-specification constant low-pressure and alternating-pressure support surfaces for preventing pressure ulcers are unclear, but alternating-pressure mattresses may be more cost effective than alternating-pressure overlays in a UK context. Medical grade sheepskins are associated with a decrease in pressure ulcer development. Organisations might consider the use of some forms of pressure relief for high risk patients in the operating theatre. PMID: 26333288 DOI: 10.1002/14651858.CD001735.pub5
OBJECTIVES: To discuss how patient considerations and the initial wound environment can affect wound treatment and summarize the way in which the initial US Wound Registry measures capture aspects of the DIME (Debridement/devitalized tissue, Infection or inflammation, Moisture balance, and wound Edge preparation/wound depth) principles.

DISCUSSION:
The treatment of chronic wounds often involves extended hospital stays and long-term outpatient follow-up visits with costly advanced therapeutic interventions. As complex care is required for chronic wounds, treatment guidelines such as DIME have evolved to include consideration of patient-centered concerns and etiology, as well as features of wound bed preparation. The US healthcare system is in the midst of transitioning to a quality-based system. However, as wound care is not yet a recognized specialty, it is poorly represented in the current approved quality-based measures.

CONCLUSION: This article helps to identify the practice guidelines that are not currently represented by quality metrics.
Creating a pressure ulcer prevention algorithm: systematic review and face validation.
van Rijswijk L, Beitz JM.

Pressure ulcer (PU) prevention is a care imperative supported by substantive evidence, but translating that knowledge into clinical decision-making at the point of care remains challenging. The purpose of this study was to create a succinct, evidence-based algorithm for inclusion in an existing industry-sponsored, evidence-based wound care program that will: 1) help clinicians assess and document overall patient PU risk; 2) help clinicians assess and address modifiable PU risk factors; and 3) guide clinicians toward an evidence-based protocol of care for patients with impaired skin integrity. First, using a systematic literature review and the Strength of Recommendation Taxonomy (SORT), a one-page algorithm containing 26 distinct decision points/steps was developed with study quality ratings for all publications identified. Second, based on the quality-of-evidence ratings, the strength of each recommendation was obtained for each decision point/step. Lastly, face validation and subsequent instrument revision based on analytic input occurred. Twelve (12) wound care experts were asked to review each decision step and rate its appropriateness/relevance on a 4-point Likert scale, where 1 = not relevant/appropriate and 4 = very relevant and appropriate. Average scores and a content validity index (CVI) were calculated for the algorithm and each individual component. Two components, the use of high-quality foam and medical grade sheepskin for at-risk patients, had sufficient evidence to receive an A strength of recommendation. However, the latter had a very low CVI (0.18). One other step, frequency of assessment for current or recent history of limited mobility (B strength of recommendation), had a low CVI (0.7). The overall literature-based level of evidence was good, but overall evidence gaps remain. The overall mean score was 3.6 (SD 0.8) with a CVI of 0.89 (out of 1). Both scores indicate strong face validity. This is the first PU prevention algorithm based on systematic literature review and face validation. Future content and construct validation is needed to refine the algorithm.

Support surfaces are an integral component of pressure ulcer prevention and treatment, but there is insufficient evidence to guide clinical decision making in this area. In an effort to provide clinical guidance for selecting support surfaces based on individual patient needs, the Wound, Ostomy and Continence Nurses Society (WOCN®) set out to develop an evidence- and consensus-based algorithm. A Task Force of clinical experts was identified who: 1) reviewed the literature and identified evidence for support surface use in the prevention and treatment of pressure ulcers; 2) developed supporting statements for essential components for the algorithm, 3) developed a draft algorithm for support surface selection; and 4) determined its face validity. A consensus panel of 20 key opinion leaders was then convened that: 1.) reviewed the draft algorithm and supporting statements, 2.) reached consensus on statements lacking robust supporting evidence, 3.) modified the draft algorithm and evaluated its content validity. The Content Validity Index (CVI) for the algorithm was strong (0.95 out of 1.0) with an overall mean score of 3.72 (out of 1 to 4), suggesting that the steps were appropriate to the purpose of the algorithm. To our knowledge, this is the first evidence and consensus based algorithm for support surface selection that has undergone content validation.

BACKGROUND: In October 2008, Centers for Medicare and Medicaid Services discontinued reimbursement for hospital-acquired pressure ulcers (HAPUs), thus placing stress on hospitals to prevent incidence of this costly condition.

OBJECTIVE: To evaluate whether prevention methods are cost-effective compared with standard care in the management of HAPUs.

RESEARCH DESIGN AND SUBJECTS: A semi-Markov model simulated the admission of patients to an acute care hospital from the time of admission through 1 year using the societal perspective. The model simulated health states that could potentially lead to an HAPU through either the practice of "prevention" or "standard care." Univariate sensitivity analyses, threshold analyses, and Bayesian multivariate probabilistic sensitivity analysis using 10,000 Monte Carlo simulations were conducted.

MEASURES: Cost per quality-adjusted life-years (QALYs) gained for the prevention of HAPUs.

RESULTS: Prevention was cost saving and resulted in greater expected effectiveness compared with the standard care approach per hospitalization. The expected cost of prevention was $7276.35, and the expected effectiveness was 11.241 QALYs. The expected cost for standard care was $10,053.95, and the expected effectiveness was 9.342 QALYs. The multivariate probabilistic sensitivity analysis showed that prevention resulted in cost savings in 99.99% of the simulations. The threshold cost of prevention was $821.53 per day per person, whereas the cost of prevention was estimated to be $54.66 per day per person.

CONCLUSION: This study suggests that it is more cost effective to pay for prevention of HAPUs compared with standard care. Continuous preventive care of HAPUs in acutely ill patients could potentially reduce incidence and prevalence, as well as lead to lower expenditures.

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CONCLUSIONS:
The SRPC could be a unique resource for quality improvement and research. The present study cannot prove causation, but it can report correlations between background variables and PU prevalence. More studies, with different designs, are warranted to establish the roles of risk factors for PU in end-of-life care.
Abstract: Objective. Wound healing is a complex and multifactorial process that requires the involvement of a multidisciplinary approach. Methods of wound measurement have been developed and continually refined with the purpose of ensuring precision in wound measurement and documentation as the primary indicator of healing. This review aims to ascertain the efficacies of current wound area measurement techniques, and to highlight any perceived gaps in the literature so as to develop suggestions for future studies and practice.

Methods. Medline, PubMed, CliniKey, and CINAHL were searched using the terms “wound/ulcer measurement techniques,” “wound assessment,” “digital planimetry,” and “structured light.” Articles between 2000 and 2014 were selected, and secondary searches were carried out by examining the references of relevant articles. Only papers written in English were included.

Results. A universal, standardized method of wound assessment has not been established or proposed. At present, techniques range from the simple to the more complex – most of which have characteristics that allow for applicability in both rural and urban settings. Techniques covered are: ruler measurements, acetate tracings/contact planimetry, digital planimetry, and structured light devices.

Conclusion. In reviewing the literature, the precision and reliability of digital planimetry over the more conventional methods of ruler measurements and acetate tracings are consistently demonstrated. The advent and utility of the laser or structured light approach, however, is promising, has only been analyzed by a few, and opens up the scope for further evaluation of this technique.
Lozano-Montoya I, Vélez-Díaz-Pallarés M, Abraha I, Cherubini A, Soiza RL, O'Mahony D5, Montero-Errasquín B, Correa-Pérez A, Cruz-Jentoft AJ.


BACKGROUND: Pressure ulcers (PUs) are frequent in older patients, and the healing process is usually challenging, therefore, prevention should be the first strategic line in PU management. Nonpharmacologic interventions may play a role in the prevention of PUs in older people, but most systematic reviews (SRs) have not addressed this specific population using convincing outcome measures.

OBJECTIVE: To summarize and critically appraise the evidence from SRs of the primary studies on nonpharmacologic interventions to prevent PUs in older patients.

DESIGN: SR and meta-analysis of comparative studies.

DATA SOURCES: PubMed, Cochrane Database of Systematic Reviews, EMBASE, and CINHAL (from inception to October 2013) were searched. A new search for updates in the Cochrane Database was launched in July 2014.

ELIGIBILITY CRITERIA FOR SELECTING STUDIES: SRs that included at least 1 comparative study evaluating any nonpharmacologic intervention to prevent PUs in older patients, in any healthcare setting, were selected. Any primary study with experimental design was then identified and included.

DATA EXTRACTION: From each primary study, quality assessment was undertaken as specified by the Cochrane Collaboration and the Grading of Recommendations Assessment, Development and Evaluation working group. Interventions were identified and compared among different studies to explore the possibility of performing a meta-analysis, using the incidence of new pressure ulcers as the main outcome measure.

RESULTS:

One hundred ten SRs with 65 primary studies satisfied the inclusion criteria. The most frequent interventions explored in these trials were support surfaces (41 studies), repositioning (8), and nutrition interventions (5). High quality of evidence was not found for any intervention, mainly because of a high risk of bias and imprecision. There is moderate quality evidence to support the use of alternating pressure support mattresses over usual hospital mattresses in medical and surgical inpatients, low quality evidence to support constant low pressure devices and Australian medical sheepskin over usual mattresses, and very low quality evidence to support nutrition interventions in hospital settings. No recommendations on hydration, repositioning, standardized risk assessment, or multicomponent interventions can be done.

CONCLUSIONS: In older patients at high risk to suffer PUs, high-technology and low-technology support surfaces can significantly reduce the incidence of PUs. Nutrition intervention may also have a role in preventing PUs in hospital settings. More evidence is needed to support other recommendations, which is specially lacking for repositioning.
BACKGROUND: A pressure ulcer (PU), also referred to as a 'pressure injury', 'pressure sore', or 'bedsore' is defined as an area of localised tissue damage that is caused by unrelieved pressure, friction or shearing forces on any part of the body. PUs commonly occur in patients who are elderly and less mobile, and carry significant human and economic impacts. Immobility and physical inactivity are considered to be major risk factors for PU development and the manual repositioning of patients in hospital or long-term care is a common pressure ulcer prevention strategy.

OBJECTIVES: The objectives of this review were to:1) assess the effects of repositioning on the prevention of PUs in adults, regardless of risk or in-patient setting;2) ascertain the most effective repositioning schedules for preventing PUs in adults; and3) ascertain the incremental resource consequences and costs associated with implementing different repositioning regimens compared with alternate schedules or standard practice.

SEARCH METHODS: We searched the following electronic databases to identify reports of the relevant randomised controlled trials: the Cochrane Wounds Group Specialised Register (searched 06 September 2013), the Cochrane Central Register of Controlled Trials (CENTRAL) (2013, Issue 8); Ovid MEDLINE (1948 to August, Week 4, 2013); Ovid EMBASE (1974 to 2013, Week 35); EBESCO CINAHL (1982 to 30 August 2013); and the reference sections of studies that were included in the review.

SELECTION CRITERIA: Randomised controlled trials (RCTs), published or unpublished, that assessed the effects of any repositioning schedule or different patient positions and measured PU incidence in adults in any setting.

DATA COLLECTION AND ANALYSIS: Two review authors independently performed study selection, risk of bias assessment and data extraction.

MAIN RESULTS: We included three RCTs and one economic study representing a total of 502 randomised participants from acute and long-term care settings. Two trials compared the 30º and 90º tilt positions using similar repositioning frequencies (there was a small difference in frequency of overnight repositioning in the 90º tilt groups between the trials). The third RCT compared alternative repositioning frequencies. All three studies reported the proportion of patients developing PU of any grade, stage or category. None of the trials reported on pain, or quality of life, and only one reported on cost. All three trials were at high risk of bias. The two trials of 30º tilt vs. 90º were pooled using a random effects model ($I^2 = 69\%$) (252 participants). The risk ratio for developing a PU in the 30º tilt and the standard 90º position was very imprecise (pooled RR 0.62, 95% CI 0.10 to 3.97, $P=0.62$, very low quality evidence). This comparison is underpowered and at risk of a Type 2 error (only 21 events). In the third study, a cluster randomised trial, participants were randomised between 2-hourly and 3-hourly repositioning on standard hospital mattresses and 4 hourly and 6 hourly repositioning on viscoelastic foam mattresses. This study was also underpowered and at high risk of bias. The risk ratio for pressure ulcers (any category) with 2-hourly repositioning compared with 3-hourly repositioning on a standard mattress was imprecise (RR 0.90, 95% CI 0.69 to 1.16, very low quality evidence). The risk ratio for pressure ulcers (any category) was compatible with a large
reduction and no difference between 4-hourly repositioning and 6-hourly repositioning on viscoelastic foam (RR 0.73, 95% CI 0.53 to 1.02, very low quality evidence). A cost-effectiveness analysis based on data derived from one of the included parallel RCTs compared 3-hourly repositioning using the 30º tilt overnight with standard care consisting of 6-hourly repositioning using the 90º lateral rotation overnight. In this evaluation the only included cost was nursing time. The intervention was reported to be cost saving compared with standard care (nurse time cost per patient €206.6 vs €253.1, incremental difference €-46.5; 95%CI: €-1.25 to €-74.60).

AUTHORS’ CONCLUSIONS: Repositioning is an integral component of pressure ulcer prevention and treatment; it has a sound theoretical rationale, and is widely recommended and used in practice. The lack of robust evaluations of repositioning frequency and position for pressure ulcer prevention mean that great uncertainty remains but it does not mean these interventions are ineffective since all comparisons are grossly underpowered. Current evidence is small in volume and at risk of bias and there is currently no strong evidence of a reduction in pressure ulcers with the 30º tilt compared with the standard 90º position or good evidence of an effect of repositioning frequency. There is a clear need for high-quality, adequately-powered trials to assess the effects of position and optimal frequency of repositioning on pressure ulcer incidence. The limited data derived from one economic evaluation means it remains unclear whether repositioning every 3 hours using the 30º tilt is less costly in terms of nursing time and more effective than standard care involving repositioning every 6 hours using a 90º tilt.

PMID: 24700291
Pressure ulcer prevention: an evidence-based analysis.

Health Quality Ontario.

Abstract
In April 2008, the Medical Advisory Secretariat began an evidence-based review of the literature concerning pressure ulcers. Please visit the Medical Advisory Secretariat Web site, http://www.health.gov.on.ca/english/providers/program/mas/tech/tech_mn.html to review these titles that are currently available within the Pressure Ulcers series. PRESSURE ULCER PREVENTION: an evidence based analysis The cost-effectiveness of prevention strategies for pressure ulcers in long-term care homes in Ontario: projections of the Ontario Pressure Ulcer Model (field evaluation) MANAGEMENT OF CHRONIC PRESSURE ULCERS: an evidence-based analysis (anticipated publication date - mid-2009) PURPOSE: A pressure ulcer, also known as a pressure sore, decubitus ulcer, or bedsore, is defined as a localized injury to the skin and or underlying tissue occurring most often over a bony prominence and caused by pressure, shear, or friction, alone or in combination. (1) Those at risk for developing pressure ulcers include the elderly and critically ill as well as persons with neurological impairments and those who suffer conditions associated with immobility. Pressure ulcers are graded or staged with a 4-point classification system denoting severity. Stage I represents the beginnings of a pressure ulcer and stage IV, the severest grade, consists of full thickness tissue loss with exposed bone, tendon, and or muscle. (1) In a 2004 survey of Canadian health care settings, Woodbury and Houghton (2) estimated that the prevalence of pressure ulcers at a stage 1 or greater in Ontario ranged between 13.1% and 53% with nonacute health care settings having the highest prevalence rate (Table 1). Executive Summary Table 1: Prevalence of Pressure Ulcers()

<table>
<thead>
<tr>
<th>Setting</th>
<th>Canadian Prevalence, % (95% CI)</th>
<th>Ontario Prevalence, Range % (n)</th>
<th>Acute care</th>
<th>25 (23.8-26.3)</th>
<th>23.9-29.7 (3418)</th>
<th>Nonacute care</th>
<th>30 (29.3-31.4)</th>
<th>30.0-53.3 (1165)</th>
<th>Community care</th>
<th>15 (13.4-16.8)</th>
<th>13.2 (91)</th>
<th>Mixed healthcare</th>
<th>22 (20.9-23.4)</th>
<th>13.1-25.7 (3100)</th>
<th>All health care settings</th>
<th>26 (25.2-26.8)</th>
<th>13.1-53.3 (7774)</th>
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| **CI indicates confidence interval.†** Nonacute care included sub-acute care, chronic care, complex continuing care, long-term care, and nursing home care.‡ Mixed health care includes a mixture of acute, nonacute, and/or community care health care delivery settings. Pressure ulcers have a considerable economic impact on health care systems. In Australia, the cost of treating a single stage IV ulcer has been estimated to be greater than $61,000 (AUD) (approximately $54,000 CDN), (3) while in the United Kingdom the total cost of pressure ulcers has been estimated at £1.4-£2.1 billion annually or 4% of the National Health Service expenditure. (4) Because of the high physical and economic burden of pressure ulcers, this review was undertaken to determine which interventions are effective at preventing the development of pressure ulcers in an at-risk population.

REVIEW STRATEGY: The main objective of this systematic review is to determine the effectiveness of pressure ulcer preventive interventions including Risk Assessment, Distribution Devices, Nutritional Supplementation, Repositioning, and Incontinence Management. A comprehensive literature search was completed for each of the above 5 preventive interventions. The electronic databases searched included MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE, the Cochrane Library, and the Cumulative Index to
Nursing and Allied Health Literature. As well, the bibliographic references of selected studies were searched. All studies meeting explicit inclusion and exclusion criteria for each systematic review section were retained and the quality of the body of evidence was determined using the Grading of Recommendation Assessment, Development, and Evaluation (GRADE) system. Where appropriate, a meta-analysis was undertaken to determine the overall estimate of effect of the preventive intervention under review.

SUMMARY OF FINDINGS:

RISK ASSESSMENT: There is very low quality evidence to support the hypothesis that allocating the type of pressure-relieving equipment according to the person's level of pressure ulcer risk statistically decreases the incidence of pressure ulcer development. Similarly, there is very low quality evidence to support the hypothesis that incorporating a risk assessment into nursing practice increases the number of preventative measures used per person and that these interventions are initiated earlier in the care continuum.

PRESSURE REDISTRIBUTION DEVICES: There is moderate quality evidence that the use of an alternative foam mattress produces a relative risk reduction (RRR) of 69% in the incidence of pressure ulcers compared with a standard hospital mattress. The evidence does not support the superiority of one particular type of alternative foam mattress. There is very low quality evidence that the use of an alternating pressure mattress is associated with an RRR of 71% in the incidence of grade 1 or 2 pressure ulcers. Similarly, there is low quality evidence that the use of an alternating pressure mattress is associated with an RRR of 68% in the incidence of deteriorating skin changes. There is moderate quality evidence that there is a statistically nonsignificant difference in the incidence of grade 2 pressure ulcers between persons using an alternating pressure mattress and those using an alternating pressure overlay. There is moderate quality evidence that the use of an Australian sheepskin produces an RRR of 58% in the incidence of pressure ulcers grade 1 or greater. There is also evidence that sheepskins are uncomfortable to use. The Pressure Ulcer Advisory Panel noted that, in general, sheepskins are not a useful preventive intervention because they bunch up in a patient's bed and may contribute to wound infection if not properly cleaned, and this reduces their acceptability as a preventive intervention. There is very low quality evidence that the use of a Micropulse System alternating pressure mattress used intraoperatively and postoperatively produces an RRR of 79% in the incidence of pressure ulcers compared with a gel-pad used intraoperatively and a standard hospital mattress used postoperatively (standard care). It is unclear if this effect is due to the use of the alternating pressure mattress intraoperatively or postoperatively or if indeed it must be used in both patient care areas. There is low quality evidence that the use of a vesico-elastic polymer pad (gel pad) on the operating table for surgeries of at least 90 minutes' duration produces a statistically significant RRR of 47% in the incidence of pressure ulcers grade 1 or greater compared with a standard operating table foam mattress. There is low quality evidence that the use of an air suspension bed in the intensive care unit (ICU) for stays of at least 3 days produces a statistically significant RRR of 76% in the incidence of pressure ulcers compared with a standard ICU bed. There is very low quality evidence that the use of an alternating pressure mattress does not statistically reduce the incidence of pressure ulcers compared with an alternative foam mattress.

NUTRITIONAL SUPPLEMENTATION: There is very low quality evidence supporting an RRR of 15% in the incidence of pressure ulcers when nutritional supplementation is added to a standard hospital diet.

REPOSITIONING: There is low quality evidence supporting the superiority of a 4-hourly
turning schedule with a vesico-elastic polyurethane foam mattress compared with a 2-hourly or 3-hourly turning schedule and a standard foam mattress to reduce the incidence of grade 1 or 2 pressure ulcers. INCONTINENCE MANAGEMENT: There is very low quality evidence supporting the benefit of a structured skin care protocol to reduce the incidence of grade 1 or 2 pressure ulcers in persons with urinary and/or fecal incontinence. There is low quality evidence supporting the benefit of a pH-balanced cleanser compared with soap and water to reduce the incidence of grade 1 or 2 pressure ulcers in persons with urinary and fecal incontinence.

CONCLUSIONS: There is moderate quality evidence that an alternative foam mattress is effective in preventing the development of pressure ulcers compared with a standard hospital foam mattress. However, overall there remains a paucity of moderate or higher quality evidence in the literature to support many of the preventive interventions. Until better quality evidence is available, pressure ulcer preventive care must be guided by expert opinion for those interventions where low or very low quality evidence supports the effectiveness of such interventions.
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PRESSURE ULCER PREVENTION: an evidence based analysis
The cost-effectiveness of prevention strategies for pressure ulcers in long-term care homes in Ontario: projections of the Ontario Pressure Ulcer Model (field evaluation)

MANAGEMENT OF CHRONIC PRESSURE ULCERS: an evidence-based analysis

OBJECTIVE: The Medical Advisory Secretariat (MAS) conducted a systematic review on interventions used to treat pressure ulcers in order to answer the following questions: Do currently available interventions for the treatment of pressure ulcers increase the healing rate of pressure ulcers compared with standard care, a placebo, or other similar interventions? Within each category of intervention, which one is most effective in promoting the healing of existing pressure ulcers?

BACKGROUND: A pressure ulcer is a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in conjunction with shear and/or friction. Many areas of the body, especially the sacrum and the heel, are prone to the development of pressure ulcers. People with impaired mobility (e.g., stroke or spinal cord injury patients) are most vulnerable to pressure ulcers. Other factors that predispose people to pressure ulcer formation are poor nutrition, poor sensation, urinary and fecal incontinence, and poor overall physical and mental health. The prevalence of pressure ulcers in Ontario has been estimated to range from a median of 22.1% in community settings to a median of 29.9% in nonacute care facilities. Pressure ulcers have been shown to increase the risk of mortality among geriatric patients by as much as 400%, to increase the frequency and duration of hospitalization, and to decrease the quality of life of affected patients. The cost of treating pressure ulcers has been estimated at approximately $9,000 (Cdn) per patient per month in the community setting. Considering the high prevalence of pressure ulcers in the Ontario health care system, the total cost of treating pressure ulcers is substantial.

TECHNOLOGY: Wounds normally heal in 3 phases (inflammatory phase, a proliferative phase of new tissue and matrix formation, and a remodelling phase). However, pressure ulcers often fail to progress past the inflammatory stage. Current practice for treating pressure ulcers includes treating the underlying causes, debridement to remove necrotic tissues and contaminated tissues, dressings to provide a moist wound environment and to manage exudates, devices and frequent turning of patients to provide pressure relief, topical applications of biologic agents, and nutritional support to correct nutritional deficiencies. A variety of adjunctive physical therapies are also in use.

METHOD: Health technology assessment databases and medical databases were searched from 1996 (Medline), 1980 (EMBASE), and 1982 (CINAHL) systematically up to March 2008 to
identify randomized controlled trials (RCTs) on the following treatments of pressure ulcers: cleansing, debridement, dressings, biological therapies, pressure-relieving devices, physical therapies, nutritional therapies, and multidisciplinary wound care teams. Full literature search strategies are reported in appendix 1. English-language studies in previous systematic reviews and studies published since the last systematic review were included if they had more than 10 subjects, were randomized, and provided objective outcome measures on the healing of pressure ulcers. In the absence of RCTs, studies of the highest level of evidence available were included. Studies on wounds other than pressure ulcers and on surgical treatment of pressure ulcers were excluded. A total of 18 systematic reviews, 104 RCTs, and 4 observational studies were included in this review. Data were extracted from studies using standardized forms. The quality of individual studies was assessed based on adequacy of randomization, concealment of treatment allocation, comparability of groups, blinded assessment, and intention-to-treat analysis. Meta-analysis to estimate the relative risk (RR) or weighted mean difference (WMD) for measures of healing was performed when appropriate. A descriptive synthesis was provided where pooled analysis was not appropriate or not feasible. The quality of the overall evidence on each intervention was assessed using the grading of recommendations assessment, development, and evaluation (GRADE) criteria.

FINDINGS:
Findings from the analysis of the included studies are summarized below: CLEANSING: There is no good trial evidence to support the use of any particular wound cleansing solution or technique for pressure ulcers. DEBRIDEMENT: There was no evidence that debridement using collagenase, dextranomer, cadexomer iodine, or maggots significantly improved complete healing compared with placebo. There were no statistically significant differences between enzymatic or mechanical debridement agents with the following exceptions: Papain urea resulted in better debridement than collagenase. Calcium alginate resulted in a greater reduction in ulcer size compared to dextranomer. Adding streptokinase/streptodornase to hydrogel resulted in faster debridement. Maggot debridement resulted in more complete debridement than conventional treatment. DRESSINGS: Hydrocolloid dressing was associated with almost three-times more complete healing compared with saline gauze. There is evidence that hydrogel and hydropolymer may be associated with 50% to 70% more complete healing of pressure ulcers than hydrocolloid dressing. No statistically significant differences in complete healing were detected among other modern dressings. There is evidence that polyurethane foam dressings and hydrocellular dressings are more absorbent and easier to remove than hydrocolloid dressings in ulcers with moderate to high exudates. In deeper ulcers (stage III and IV), the use of alginate with hydrocolloid resulted in significantly greater reduction in the size of the ulcers compared to hydrocolloid alone. Studies on sustained silver-releasing dressing demonstrated a trend for reducing the risk of infection and promoting faster healing, but the sample sizes were too small for statistical analysis or for drawing conclusions. BIOLOGICAL THERAPIES: The efficacy of platelet-derived growth factors (PDGFs), fibroblast growth factor, and granulocyte-macrophage colony stimulating factor in improving complete healing of chronic pressure ulcers has not been established. Presently only Regranex, a recombinant PDGF, has been approved by Health Canada and only for treatment of diabetic ulcers in the lower extremities. A March 2008 US Food and Drug Administration (FDA) communication reported increased deaths from
cancers in people given three or more prescriptions for Regranex. Limited low-quality evidence on skin matrix and engineered skin equivalent suggests a potential role for these products in healing refractory advanced chronic pressure ulcers, but the evidence is insufficient to draw a conclusion. ADJUNCTIVE PHYSICAL THERAPY: There is evidence that electrical stimulation may result in a significantly greater reduction in the surface area and more complete healing of stage II to IV ulcers compared with sham therapy. No conclusion on the efficacy of electrotherapy can be drawn because of significant statistical heterogeneity, small sample sizes, and methodological flaws. The efficacy of other adjunctive physical therapies [electromagnetic therapy, low-level laser (LLL) therapy, ultrasound therapy, ultraviolet light therapy, and negative pressure therapy] in improving complete closure of pressure ulcers has not been established. NUTRITION THERAPY: Supplementation with 15 grams of hydrolyzed protein 3 times daily did not affect complete healing but resulted in a 2-fold improvement in Pressure Ulcer Scale for Healing (PUSH) score compared with placebo. Supplementation with 200 mg of zinc three times per day did not have any significant impact on the healing of pressure ulcers compared with a placebo. Supplementation of 500 mg ascorbic acid twice daily was associated with a significantly greater decrease in the size of the ulcer compared with a placebo but did not have any significant impact on healing when compared with supplementation of 10 mg ascorbic acid three times daily. A very high protein tube feeding (25% of energy as protein) resulted in a greater reduction in ulcer area in institutionalized tube-fed patients compared with a high protein tube feeding (16% of energy as protein). Multinutrient supplements that contain zinc, arginine, and vitamin C were associated with a greater reduction in the area of the ulcers compared with standard hospital diet or to a standard supplement without zinc, arginine, or vitamin C. Firm conclusions cannot be drawn because of methodological flaws and small sample sizes. MULTIDISCIPLINARY WOUND CARE TEAMS: The only RCT suggests that multidisciplinary wound care teams may significantly improve healing in the acute care setting in 8 weeks and may significantly shorten the length of hospitalization. However, since only an abstract is available, study biases cannot be assessed and no conclusions can be drawn on the quality of this evidence.
INTRODUCTION — Pressure ulcers are lesions caused by unrelieved pressure that results in damage to the underlying tissue. Generally, these are the result of soft tissue compression between a bony prominence and an external surface for a prolonged period of time \[1,2\]. The consequences of pressure-induced skin injury range from nonblanchable erythema of intact skin to deep ulcers extending to the bone.

The ulcer imposes a significant burden not only on the patient, but the entire health care system. Reducing the frequency of pressure ulcers is an important component of current goals for patient safety as evidenced by the Institute for Healthcare Improvement (IHI) 5 Million Lives Campaign, and the decision by the United States Center for Medicare and Medicaid Services to not reimburse hospitals for the treatment of hospital-acquired pressure ulcers \[3-5\].

Knowledge of factors contributing to the pathogenesis of pressure ulcers allows the identification of patients at risk for ulcer development such that preventive measures may then be targeted to those specific patients. The epidemiology, pathogenesis, risk factors, and risk assessment of pressure ulcers will be reviewed here. Prevention and treatment are discussed separately. (See "Prevention of pressure ulcers" and "Clinical staging and management of pressure-induced injury".)
INTRODUCTION — A pressure ulcer, also referred to as a pressure injury [1], is a localized area of damage to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear (eg, sacrum, calcaneus, ischium) (figure 1). The superficial skin is less susceptible to pressure-induced damage than deeper tissues, and thus, the external appearance may underestimate the extent of damage [2]. Pressure ulcers are typically related to immobility (ie, bed-bound or chair-bound individual), but can also result from poorly fitting casts or other medical equipment or devices. The clinical staging that guides treatment of pressure ulcers is reviewed here. The pathogenesis, risk assessment, and preventive strategies are discussed elsewhere. (See "Epidemiology, pathogenesis and risk assessment of pressure ulcers" and "Prevention of pressure ulcers".)
INTRODUCTION — Pressure ulcers are among the most common conditions encountered in hospitalized patients or those requiring long-term institutional care [1]. Ulcer prevention is a cost-effective approach that positively impacts health status [2-6]. As of October 2008, guidelines from the Center for Medicare and Medicaid Services (CMS) in the United States state that hospitals will no longer receive additional payments when patients develop stage 3 or 4 pressure ulcers (table 1) [7]. Failure to provide appropriate pressure ulcer prevention and care may also expose providers to liability [8].

The prevention of pressure ulcers will be reviewed here. The treatment, epidemiology, pathogenesis, clinical manifestations, and staging are discussed separately. (See "Epidemiology, pathogenesis and risk assessment of pressure ulcers" and "Clinical staging and management of pressure-induced injury".)