

PENNSYLVANIA PRESSURE ULCER PARTNERSHIP

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Pressure Ulcer Prevention

## Research Summary

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## Introduction

This report focuses on prevention of facility-acquired pressure ulcers in the hospital and long-term care settings. Recent systematic reviews, guidelines, and published clinical studies provide the evidence base, and case studies round out the picture by providing information on effectiveness of interventions in “real-world” settings. Also included in this report are standards from accreditation and regulating authorities and some illustrative policy initiatives in the United States.

“Pressure ulcer” is the term used to describe tissue damage associated with pressure-induced ischemia and its consequences. While traditionally pressure ulcers have been ascribed to occlusion of capillary blood flow when pressure exceeds 32 mmHg, other important factors in creation of these wounds include shear-induced deformation of tissue, impaired lymphatic function leading to accumulation of cellular waste products, and the reperfusion of tissue with these waste products and inflammatory mediators when pressure is relieved.<sup>1</sup> “Shear” refers to tissue layers sliding against each other when forces are applied in opposite directions; “friction” in this context refers to skin rubbing against an external surface. Muscle tissue in close proximity to bone is particularly vulnerable to the effects of pressure. Damage to the epidermis, dermis and subcutaneous fat may be secondary to deeper tissue injury, shear or friction, and may not appear until after deep tissue injury is already significant. Sources of pressure damage include bed and chair surfaces, as well as medical devices (particularly orthopedic devices), tubing, operating room and radiology devices and tables, and ambulance, emergency room or transport stretchers.

The National Pressure Ulcer Advisory Panel has made very important contributions to this field by using published evidence and expert consensus. In 2007, the group issued new staging criteria which have important implications for prevention efforts.<sup>2</sup> The current staging system is as follows:

Suspected deep tissue injury: Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue. Deep tissue injury may be difficult to detect in individuals with dark skin tones. Evolution may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar. Evolution may be rapid, exposing additional layers of tissue even with optimal treatment.

Stage I: Intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area. The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Stage I may be difficult to detect in individuals with dark skin tones. May indicate “at risk” persons (a heralding sign of risk).

Stage II: Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister. Presents as a shiny or dry shallow ulcer without slough or bruising. (Bruising indicates suspected deep tissue injury.) This stage should not be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation.

Stage III: Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle is not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling. The depth of a stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage III pressure ulcers. Bone/tendon is not visible or directly palpable.

Stage IV: Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling. The depth

of a stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and these ulcers can be shallow. Stage IV ulcers can extend into muscle and/or supporting structures (e.g., fascia, tendon or joint capsule) making osteomyelitis possible. Exposed bone/tendon is visible or directly palpable.

Unstageable: Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed. Until enough slough and/or eschar is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined. Stable (dry, adherent, intact without erythema or fluctuance) eschar on the heels serves as "the body's natural (biological) cover" and should not be removed.<sup>2</sup>

Some controversy exists around the labeling of more superficial skin damage as "pressure ulcers," as many superficial lesions are related primarily to friction or moisture. Many wound care experts have pointed out that clinicians sometimes mistake skin lesions related to moisture damage, particularly in the pelvic region, with pressure ulcers, and have encouraged more educational efforts to address this issue, as the prevention and management implications are somewhat different.<sup>3</sup>

## Risk Data and Trends

Pressure ulcers are among the more common hospital- and long-term care-acquired conditions. Nationally, there is wide variation in the incidence of facility-acquired pressure ulcers. The most commonly quoted rates come from the 2001 NPUAP publication, “Pressure Ulcers in America: Prevalence, Incidence, and Implications for the Future.” The incidence rates ranged from 0.4% to 38% in acute care, from 2.2% to 23.9% in long-term care, and up to 17% in home care.<sup>4</sup> Current data on hospital incidence and prevalence rates also show substantial variation across units even within individual hospitals. Much of this variation reflects differences in patients’ susceptibility to injury, and differences in exposure to external risk factors; however, differences in assessment skills and variations in prevention and management strategies likely account for a significant portion of the variation. Benchmarking data are available for both hospitals and long-term care facilities, and is increasingly used by facilities to initiate system-wide changes for improvement.

Of the 39,450,216 discharges from acute care hospitals in the U.S. in 2006, 1,079,971 individuals were discharged with a diagnosis of pressure ulcer (2.7% of all discharges). Pressure ulcers leading to hospitalization are particularly costly. Of the 78,816 discharges for which pressure ulcer was the primary diagnosis, mean charges were \$39,754 (<http://hcupnet.ahrq.gov/>). As of October 1, 2008, CMS will no longer allow higher DRG payments for patients with hospital-acquired Stage III and IV pressure ulcers.<sup>5</sup>

From the 2005 data in the Healthcare Cost and Utilization Project (HCUP) database maintained by the Agency for Healthcare Research and Quality (AHRQ) and the AHRQ Patient Safety Indicator for development of pressure ulcers, it is apparent that pressure ulcer incidence increased dramatically by age:

**Table 1. Rates of pressure ulcer occurrence by age, U.S. Hospitals, 2005**

Age Group	Rate per 1,000 discharges*
18–44	5.5
45–64	15.2
65–69	24.6
70–74	25.3
75–79	33.7
80–84	34.1
Over 85	50.2

\* Adjusted by patient and hospital characteristics; where length of stay is  $\geq 5$  days in individuals  $\geq 18$  years and excluding transfers, patients admitted from long-term care facilities, those with other skin or subcutaneous tissue diagnoses and obstetrical admissions.

For a number of years, long-term care facilities have been surveyed regarding the prevalence of pressure ulcers.<sup>6</sup> CMS reported that the prevalence of pressure ulcers among high-risk long-term care residents (those residents who have impaired mobility, are comatose, or are malnourished) in Pennsylvania was 13.5% for the most recently-reported period of October to December 2007. The percentage of low-risk residents (residents meeting none of the high-risk criteria) with pressure ulcers was 3.5% during the same time period. Both of these rates trend close to the national averages (13.4% and 2.8%, respectively).<sup>7</sup>

### ***Pennsylvania Patient Safety Reporting System (PA-PSRS)***

The Pennsylvania Patient Safety Reporting System (PA-PSRS) has been collecting information on pressure ulcers since June 2004. The PA-PSRS definition of pressure ulcer corresponds to the National

Pressure Ulcer Advisory Panel definition. In an advisory published in September 2006 regarding data collected between June 2004 and December 2005, PA-PSRS noted that while pressure ulcers occurred in patients of all ages, the highest incidence was in the elderly, with an average age of 73. Of the reports of pressure ulcers that developed after admission, 16% were in patients assessed as being at low risk, 45% in patients assessed at high risk; however, in 39% of those with no ulcer documented on admission, no risk assessment had been documented.<sup>8</sup>

For acute care hospitals, the Pennsylvania Patient Safety Authority received over 13,500 reports in 2007 related to pressure ulcers, with nearly 4,300 of that number considered “hospital acquired.” It is likely that pressure ulcer occurrences are under-reported. Applying the national rate to Pennsylvania data suggests an annual estimate of 51,000 cases statewide.

The most recent data on the number and stage of ulcers described in the reports to PA-PSRS are presented in Table 2 below.

**Table 2. Pressure Ulcer Reports to PA-PSRS in 2007**

<b>Pressure Ulcers in Pennsylvania 2007</b>	<b>Stage I</b>	<b>Stage II</b>	<b>Stage III</b>	<b>Stage IV</b>	<b>Stage Not Identified</b>	<b>Total Reports</b>
Admitted from other facility with ulcer	1,043 (12%)	3,497 (41%)	781 (9%)	650 (8%)	2,510 (30%)	8,481
New ulcer <24 hrs after admission	156 (22%)	313 (45%)	49 (7%)	22 (3%)	162 (23%)	702
New ulcer >24 hours after admission	779 (18%)	2,104 (49%)	106 (2%)	37 (1%)	1,306 (30%)	4,332
<b>Total number of reports</b>	<b>1,978</b>	<b>5,914</b>	<b>936</b>	<b>709</b>	<b>3,978</b>	<b>13,515</b>

## Patient Safety Initiatives

### *Institute for Healthcare Improvement (IHI)*

The Institute for Healthcare Improvement (IHI) launched the 5 Million Lives Campaign in December 2006 with a goal of protecting patients from five million incidents of harm by December 2008. Prevention of pressure ulcers is an important focus of the program. IHI has made a guideline available to hospitals for developing a pressure ulcer prevention initiative.<sup>9</sup> The recommendations include the following six elements:

1. Conduct a pressure-ulcer admission assessment for all patients
2. Reassess risk for all patients daily

For those at risk:

3. Inspect skin daily
4. Manage moisture: keep patient dry and moisturize skin
5. Optimize nutrition and hydration
6. Minimize pressure

Turn/reposition patients every two hours

Use pressure-relieving surfaces

For each element, recommendations are made for implementing processes or making changes to ensure that these practices are successfully accomplished. Several case studies from the program are discussed later in this report.<sup>10</sup>

### **CMS**

Working through the Quality Improvement Organizations (QIOs), CMS is continuing to strive for reduction in pressure ulcers in nursing homes. The most recent campaign, *Advancing Excellence in America's Nursing Homes*, set the following goals for September 2008:

- The national average (prevalence) of facility-acquired pressure ulcers: in high-risk residents (defined by immobility, being comatose, or malnourished) less than 10%
- 30% of nursing homes reduce the rate to less than 6%
- No nursing home has a rate over 24% ([www.nhqualitycampaign.org](http://www.nhqualitycampaign.org))

Extensive resources are provided to facilities through the Quality Improvement Organizations in each state and on the Web site of the Medicare Quality Improvement Community (Med-QIC). This resource was redesigned in 2004 in partnership with IHI, and launched in 2005. ([www.medqic.org](http://www.medqic.org))

This campaign builds on years of effort to improve the rates of pressure ulcers in nursing homes, including the Nursing Home Quality Initiative, which began in 2002. In 2001, Lyder et al. reported on a quality assessment of nursing homes in Connecticut.<sup>11</sup> The study found low rates of compliance with standards such as placing bed- or chair-bound individuals on pressure-reducing surfaces (7.5%), repositioning these individuals every two hours (66.2%), performing and documenting risk assessments in immobile patients with at least one other risk factor within 48 hours of admission (22.6%) or obtaining nutritional consultation in patients who had markers for malnutrition (defined as weight <80% of ideal body weight, total lymphocyte count <1.8 X 10<sup>9</sup>/L or albumin <3.5 mg/dL)(34.3%).<sup>11</sup> CMS encouraged QIOs to develop programs to address such problems. One developed by the Louisiana QIO provides useful checklists and forms for the LTC setting to meet CMS requirements.<sup>12</sup> Another program is that produced by the Massachusetts PRO in 2003, "A Systems Approach to Quality Improvement in Long-Term Care: Pressure Ulcer Prevention and Management." This document provides useful suggestions for assessing and improving organizational commitment to improvement in this area, and breaks down the

tasks necessary for instituting a program to address pressure ulcer prevention. Many of the suggestions are applicable to other care settings as well.<sup>13</sup>

### ***Agency for Healthcare Research and Quality***

The Agency for Healthcare Research and Quality, with support from the California Health Foundation, has been sponsoring a research and support initiative for long-term care facilities entitled “On Time Quality Improvement for Long Term Care.” A major goal of this initiative is to reduce the incidence of pressure ulcers by improving daily documentation by front-line nursing staff and enhancing communication using information technology.<sup>14</sup>

### ***State Initiatives***

The National Academy of State Health Policy (NASHP) reported that by October of 2007, 26 states and the District of Columbia had passed legislation or regulations requiring hospital reporting of adverse events to state agencies. ([www.pstoolbox.org](http://www.pstoolbox.org)) The NASHP Web site provides links to the Web sites of the state reporting systems, in addition to tools developed for data collection, data analysis and other resources. Maryland, Minnesota, New Jersey and Pennsylvania are among the states requiring hospitals to report facility-acquired pressure ulcers.

In Minnesota, nearly one-third of the serious adverse events reported in 2006 were pressure ulcers. In February 2007, the Minnesota Hospital Association launched the SAFE SKIN initiative to promote best practices for pressure ulcer prevention. To participate in the initiative, hospital CEOs were required to sign a participation agreement and to designate an individual to be responsible for implementing the program in the facility. Hospitals have begun to report successes in processes of care (e.g., use of pressure-reducing support surfaces) and in the incidence of hospital-acquired pressure ulcers.<sup>15</sup>

In New Jersey, a similar effort has been underway utilizing IHI’s recommendations for pressure ulcer prevention. This initiative included 125 hospitals, nursing homes, home health and rehabilitation settings. The acronym “No Ulcers” outlined the elements of the program—“**N**utrition and fluid status, **O**bservation of skin, **U**p and walking or turn and position, **L**ift (don’t drag) skin, **C**lean skin and continence care, **E**levate heels, **R**isk assessment, and **S**upport surfaces for pressure redistribution.” Over a 20-month data-collection and reporting period, a 70% reduction in pressure ulcer incidence was reported.<sup>16</sup>

## Standards

### ***Joint Commission***

The Joint Commission has focused on facility-acquired pressure ulcers primarily in the long-term care setting, and has included the prevention of pressure ulcers as a National Patient Safety Goal for several years. The most recent standards are described below:

#### **Joint Commission 2008 National Patient Safety Goals: Long Term Care**<sup>17</sup>

Goal 14: Prevent health care-associated pressure ulcers (decubitus ulcers).

##### Requirement 14A

Assess and periodically reassess each [patient]'s risk for developing a pressure ulcer (decubitus ulcer) and take action to address any identified risks.

##### Rationale for Requirement 14A

Pressure ulcers (decubiti) continue to be problematic in all health care settings. Estimates are that 1.3 to 3 million adults have a pressure ulcer. The cost of treatment is \$500 to \$40,000 per ulcer. The incidence of pressure ulcer is from 2.2% to 23.9% in long term care and 0% to 17% in home care. Most pressure ulcers can be prevented and deterioration at Stage I can be halted. The use of clinical practice guidelines can effectively identify [patients] and define early intervention for prevention of pressure ulcers.

##### Implementation Expectations for Requirement 14A

A 1. There is a plan for the prediction, prevention, and early treatment of pressure ulcers, which addresses:

- Identifying individuals at risk and the specific factors placing them at risk.
- Maintaining and improving tissue tolerance to pressure in order to prevent injury.
- Protecting against the adverse effects of external mechanical forces.
- Reducing the incidence of pressure ulcers through staff educational programs.

(M) C 2. Initial assessments are performed at admission.

(M) C 3. A systematic risk assessment is conducted using a validated risk assessment tool such as the Braden Scale or Norton Scale.

(M) C 4. Pressure ulcer risk is reassessed at periodic intervals.

(M) C 5. Action is taken to address any identified risks.

Joint Commission recommends performing risk assessments at the time of admission, then weekly and with significant worsening in health or functional status. Joint Commission further recommends a multi-component approach to prevention for residents of long-term care facilities:<sup>18</sup>

- Skin inspection, skin cleansing, care for dry skin, use of moisture barriers and massage
- Nutritional support based on an individualized nutritional needs assessment
- Avoidance of skin injury from friction or shear forces through the use of positioning, transferring and turning techniques
- A plan to maintain and, when appropriate, to increase mobility and activity level

- Improvement in positioning, repositioning, transferring and turning techniques to reduce skin injury caused by friction and shear force
- Use of repositioning devices, and mechanical loading and support surfaces to reduce skin injury caused by friction or shear force

### ***National Quality Forum***

This organization has recently begun working with 27 different national organizations to create the National Priorities Partnership, co-chaired by Don Berwick of IHI and Margaret O’Kane of the National Committee for Quality Assurance (NCQA). This partnership is charged with setting national priorities for performance measurement and public reporting. The membership includes quality alliances (e.g., Hospital Quality Alliance, Alliance for Pediatric Quality), consumer representatives (e.g., Consumers Union, AARP, AFL-CIO), purchasers (e.g., The Leapfrog Group, National Business Group on Health), healthcare providers (e.g., American Nurses Association, AMA), accreditation and certification programs (e.g., Joint Commission, NCQA), insurers (America’s Health Insurance Plans), government agencies (e.g., CMS, CDC, AHRQ, NIH, National Governors Association), IHI and the IOM. (See <http://www.qualityforum.org/about/NPP/>)

A set of proposed priority areas and goals are available on the NQF Web site for public comment. Among the goals on safety is the following: “By 2014, all providers will drive the incidence of preventable NQF Serious Reportable Events (SRE) to zero.” Under this goal is the goal that by 2012, “all providers will drive high-frequency nursing-sensitive events (e.g., Stage III & IV pressure ulcers, falls and trauma) to zero.” (See draft recommendations for priorities and goals at [http://www.qualityforum.org/about/NPP/assets/NPP\\_Goals\\_07\\_03\\_08.pdf](http://www.qualityforum.org/about/NPP/assets/NPP_Goals_07_03_08.pdf))

## **Guidelines**

Several clinical practice guidelines have been produced and/or updated in the past five years. Most still rely heavily on the work done by Nancy Bergstrom, PhD, RN, FAAN and others.<sup>19</sup> The following guidelines listed below are currently indexed in the National Guideline Clearinghouse™ (NGC). The Clearinghouse staff have produced a synthesis document on pressure ulcer prevention which allows the reader to compare the guidelines in terms of scope, target population, intended users, practices and interventions considered, and recommendations for each practice or intervention.<sup>20</sup> Many of the guideline recommendations still rely heavily on expert opinion.

### ***The John A. Hartford Foundation Institute for Geriatric Nursing***

The 2008 version of this guideline is currently being updated for publication in the National Guideline Clearinghouse, but is available from the publisher. The 2003 version is included in the Guideline Synthesis document on the NGC Web site.<sup>20,21</sup> The chapter on pressure ulcers covers recommendations for assessment and prevention both for pressure ulcers and for skin tears. Of note, the recommendation is made to set the threshold for determining that an individual is at risk at a Braden score of 18 for the elderly and for dark-skinned persons.<sup>22</sup>

### ***American Medical Directors Association***

The American Medical Directors Association (AMDA) is the professional association of medical directors, attending physicians, and others practicing in the long term care continuum. This organization has produced guidelines which are represented in the National Guidelines Clearinghouse, with the most recent update published in 2008.<sup>23</sup> AMDA has also created quality measures accompanying the guidelines to improve implementation. These quality measures are represented in the National Quality Measures Clearinghouse.<sup>24</sup>

### ***Registered Nurses Association of Ontario***

This Canadian guideline, published in 2005, provides recommendations for assessment and prevention of pressure ulcers across settings. The guideline developers made use of the recommendations in the original AHCPR guideline. This guideline stresses that while use of a standardized tool for risk assessment is very important for care planning, clinical judgment regarding additional risk factors (intrinsic and extrinsic) are necessary.<sup>25</sup>

### ***Wound, Ostomy, and Continence Nurses Society***

This guideline, published in 2003, is intended for use by a wide variety of healthcare providers. It recommends regularly scheduled risk assessments in all settings. Preventive interventions most strongly recommended include regular turning and repositioning (every two hours on a non-pressure-reducing surface and every two to four hours on a pressure-reducing surface), use of pressure-reducing surfaces in the operating room, and relief of pressure under heels by using pillows or other devices.<sup>26</sup>

### ***National Collaborating Centre for Nursing and Supportive Care, National Institute for Clinical Excellence***

This guideline differs from the others in that it recommends the use of risk assessment scales only as an adjunct to clinical judgment. Recommendations for institutions, as well as practitioners, are provided in this guideline, published in 2003.<sup>27</sup>

## ***Institute for Clinical Systems Improvement***

The Institute for Clinical Systems Improvement (ICSI) in Minnesota published a protocol for risk assessment and prevention of pressure ulcers in acute care settings (inpatient and outpatient) in March 2007. This protocol has been successfully implemented by hospitals in Minnesota, as described later in this report.<sup>28</sup>

## Evidence-based Practices

### *Risk Factors and Risk Assessment*

#### **Systematic Reviews**

Four recent systematic reviews focused on the topic of assessing patients for risk of pressure ulcers.

Pancorbo-Hidalgo et al. (2006) reviewed three studies of the clinical impact of the use of risk assessment scales and found no evidence that risk assessments alone reduced the incidence of pressure ulcers.<sup>29</sup> They pointed out that the Braden risk assessment tool had been examined in 22 validation studies, which varied in the populations studied, the length of follow up and the threshold score used to define increased risk. Despite flaws in the studies, the authors concluded that the Braden scale provided the best risk estimates of the currently available tools.<sup>29</sup> Bolton (2007) performed a review of risk assessment methods and concluded that the Braden, Norton and Waterlow scales were valid across settings and countries.<sup>30</sup>

In the review by de Laat et al. (2006), 19 studies of risk assessment for critically ill patients were examined. The authors concluded that none of the risk factor analyses or risk scale validation studies were methodologically sound enough to endorse in this population. In particular, the failure to account for the impact of preventive interventions instituted in response to the score was of concern.<sup>31</sup> Another review of risk assessment in intensive care patients was performed by Keller et al. (2002) which also concluded that the studies in this setting were too flawed to endorse any of the available scales.<sup>32</sup>

#### **Other Published Literature**

Risk scores, like diagnostic tests, are never perfect predictors of patient outcomes. Whenever a threshold is set at a level intended to capture all patients at risk (maximally sensitive), there is a trade-off made resulting in over-estimation of risk (and possibly institution of unnecessary preventive measures) for some patients. On the other hand, if the threshold is set to avoid labeling patients “at risk” who are not in fact at risk, many truly at-risk individuals will not be detected. Given a test result or risk assessment score, the clinician is still faced with estimating the probability that the prediction is correct—an estimation that requires knowledge of the prevalence of the condition in similar individuals as well as additional risk factors not covered by the scale for a given individual. For a positive risk screen or test result, this is referred to as the predictive value of a positive test. This value is probably less than 10% for the commonly used risk scales in hospitalized patients who are not critically ill, not undergoing surgery, and not elderly at the typical cut-offs (e.g., <18 on the Braden scale). The consequence of this is that more patients will receive preventive interventions that would not have developed a pressure ulcer. However, at a threshold of 18, patients who have other risk factors not captured by the scale will not be labeled “at risk” and opportunities for prevention may be missed.

Many investigators have advocated lowering the threshold score for the Braden instrument to a lower level in the populations who are thought to be at lower risk by other characteristics, and setting it higher (more likely to label a patient “at risk”) for patients in whom factors not captured by the risk assessment scale put them at higher risk. In reviewing recent literature, we noted some of these additional risk factors that need to be considered in making a judgment about risk in addition to the patient’s score on a risk assessment scale. Also, some researchers in this field would argue for weighting some of the items on the commonly used scales to give additional emphasis to particular patient characteristics—mobility and cognitive function, in particular.

The scale developed by Schoonhoven et al uses a weighted approach to scoring of risk factors identified in the course of a large clinical study.<sup>33</sup> Based on data collected on 1229 patients in two hospitals in the Netherlands between January 1999 and June 2000, they examined a large number of possible risk factors. Independent risk factors identified as most predictive of Stage II or higher pressure ulcers included

surgery in the coming week (14 points), age >75 years (10 points), age 50–74 (6 points), weight on admission <54 kg (3 points) or ≥95 kg (8 points), abnormal appearance of the skin (dry, discolored or damaged) (7 points), and a potential or actual problem with friction or shear (7 points). The investigators found that a threshold score of 20 points was best for predicting pressure ulcers of stage II or higher. While the risk assessment tool still requires prospective validation in other settings, in this group of patients it correctly identified 70% of the patient weeks in which pressure ulcers occurred.<sup>33</sup>

A number of additional studies emphasized the importance of risk factors in surgical patients both in the operating room and during post-operative care.<sup>34-43</sup> Several of these studies emphasized the importance of pre- and post-operative cognitive function and mobility. The risk of pressure ulcers is typically much greater for critically ill patients. In many cases, this is predicted by the commonly used risk assessment tools, but several studies published since 2001 have attempted to improve prediction in this population.<sup>36,44-50</sup>

Fogerty et al. used the AHRQ HCUP Nationwide Inpatient Sample (NIS) of hospital discharges in 2003 to examine risk factors. Although there may be residual confounding after accounting for age, they found that African-Americans had significantly higher risk than Caucasians at all age ranges, with the risk differential increasing with age. At age >75 years, the odds ratio (OR) for African-Americans was 5.71 vs. 2.35 for Caucasians. The authors also found that the following diagnoses were associated with significant increases in risk of pressure ulcers: gangrene (OR: 10.94), paralysis (OR: 10.30), septicemia (OR: 9.78) and osteomyelitis (OR:9.38).<sup>51</sup>

Other studies have examined risk factors for pressure ulcers in children.<sup>52-58</sup> In children, important risk factors include orthopedic devices (such as plaster, splints, braces and traction devices), reduced mobility, inadequate nutrition, and recent surgery.

## ***Interventions for Preventing Pressure Ulcers***

### **Systematic Reviews and Technology Assessments**

#### **Evidence-based Practice Centers**

The Stanford Evidence-based Practice Center (EPC) produced an evidence report on a variety of patient safety practices in 2001. Included was a chapter reviewing interventions for prevention of pressure ulcers. The authors concluded that there was sufficient evidence to recommend the use of pressure reduction surfaces and mattresses rather than standard hospital foam mattresses. They cautioned that it was difficult to recommend any particular type of pressure reduction device and that it was unclear how best to target the patients most likely to benefit.<sup>59</sup>

#### **The Cochrane Collaboration**

Cullum et al. (2004) performed a systematic review of randomized controlled trials (RCTs) assessing the effectiveness of beds, mattresses, mattress overlays, and seating cushions for patients in any setting. They concluded that standard hospital mattresses were inferior to high-specification foam mattresses, although it was difficult to recommend any particular alternative foam device. Unfortunately, many studies were poorly designed or included too few patients to draw meaningful conclusions. The same problems with study design and number of patients prevented evidence-based conclusions regarding the efficacy of alternating pressure and low air-loss beds and seat cushions.<sup>60</sup> This absence of conclusive evidence does not prove that the devices have no effect, simply that the evidence published as of 2004 did not prove that they are effective. A study would need a minimum of 600 patients per group to have an 80% chance of demonstrating a reduction in pressure ulcer incidence from 10% to 5%.

### **Other published systematic reviews of interventions**

Reddy et al. (2006) also examined RCTs of support surfaces, along with interventions targeting impaired mobility, nutritional needs and incontinence care. They too concluded that while studies of these interventions are of suboptimal quality, use of pressure-reducing mattress replacements instead of standard hospital mattresses, use of pressure-reducing overlays on operating tables, repositioning patients who have impaired mobility, optimizing nutrition and moisturizing dry sacral skin could be recommended.<sup>61</sup>

### **Recent published studies of interventions for the prevention of pressure ulcers**

de Laat et al. (2007) examined the impact of implementing clinical practice guideline-based care in the critical care setting, and found that after adjusting for a number of risk factors, the strongest predictor of a decrease in pressure ulcers was transfer of patients to pressure-reducing mattresses (hazard rate ratio 0.22,  $p < 0.001$ ). The number needed to prevent one pressure ulcer in the first nine days of hospitalization was six patients. This effect still persisted 12 months after implementation of the program.<sup>62</sup>

## Case Studies

### ***Stony Brook University Medical Center***

Stony Brook University Medical Center (SBUMC) reported its success with implementation of a pressure ulcer prevention program based on the “bundle” concept from the Institute for Healthcare Improvement. The medical center had already been participating in an annual pressure ulcer prevalence and incidence benchmarking study by KCI USA, Inc., in which it was compared to other tertiary care hospitals with more than 500 beds. SBUMC found that its rates overall, in the ICU, and on medical-surgical units were above national benchmarks. A staff survey identified a lack of awareness of the higher than average rates as well as knowledge gaps regarding the prevention and recognition of pressure ulcers. The task force subsequently developed a Pressure Ulcer Prevention Program, in which a number of strategies were bundled. The bundle included eight components: (1) skin assessment every eight hours; (2) completion of a Braden risk assessment daily, on transfer to another unit or with increase in acuity; (3) prevention of shear injury by avoiding elevation of the head of the bed to more than 30° unless medically necessary; with flexion of the knees when the head of the bed is elevated; (4) moisture prevention by use of moisture barrier ointment applied every eight hours and following every episode of incontinence, and avoidance of diapers or other garments likely to hold moisture close to the skin; (5) turning and repositioning every two hours when in bed and every hour when in a chair; (6) heel elevation without causing pressure to the Achilles tendon; (7) nutrition consults for all patients with Braden scores in the at-risk range and concerted efforts to “catch up” on nutritional needs missed because of tests or procedures; and (8) pressure relief mattresses for the majority of patients in the hospital. The program was first implemented in the critical care units, which had the highest incidence and prevalence rates, beginning with a three-week educational program covering the causes and locations of pressure ulcers, the bundle components, the impact of hospital-acquired pressure ulcers in terms of staff time and cost to the hospital, unit and hospital prevalence and incidence compared to benchmarks, and the plans for evaluation, audit and communication of pressure ulcer rates to all staff. Important features of the program included monthly prevalence and incidence studies with prompt feedback in unit-level educational meetings.<sup>63</sup>

### ***Ascension Health***

Ascension Health, the largest non-profit healthcare system in the country, launched its “Healthcare That is Safe” initiative in 2004. One site, St. Vincent’s Medical Center in Jacksonville, Florida, was charged with defining best practices for reducing facility-acquired pressure ulcers. Using the “bundle” approach designated by the acronym, “SKIN” (Surfaces, Keep the patients turning, Incontinence management, Nutrition), St. Vincent’s reduced pressure ulcer incidence from <2% to <1% between December 2004 and February 2006. Furthermore, no new Stage III or IV facility-acquired pressure ulcers developed in that time period. In mid-2005, all of Ascension’s 67 acute care facilities agreed to implement a single model of care using this bundle, and agreed to common measures of quality and performance. In a very useful article published in 2006, the processes of organizational preparation, implementation and measurement for this initiative are described.<sup>64</sup>

### ***Genesis Medical Center - Davenport***

Another medical center, Genesis Medical Center in Davenport, Iowa, also worked to use a “bundle” approach to standardizing care practices to reduce the incidence of hospital-acquired pressure ulcers. They found that using the American Nurses Association’s National Database of Nursing Quality Indicators (NDNQI®) was very helpful for benchmarking and monitoring their efforts. Components of their program included an assessment of baseline knowledge levels among the nursing staff to identify internal resources and consultation services, and to create successful work patterns. They standardized risk assessment by using the Braden scale and created algorithms for patients “at risk” and for those at

“high risk.” In a publication in the Joint Commission Journal on Quality and Patient Safety in October 2007, they provide their algorithms, which use the mnemonic “TOE” to remind staff to Turn, use a pressure reduction Overlay and to Elevate the heels off of the bed.<sup>65</sup>

### ***Aurora Sinai Medical Center***

Aurora Sinai Medical Center in Milwaukee, Wisconsin, took the interesting approach of engaging transport workers in their efforts to reduce pressure ulcers. Transport workers were told to refuse to transport patients without identification bands (to avoid delays once they were transported for procedures), and to transport patients on their beds rather than stretchers (to avoid risk for shear injuries from more frequent transfers on and off beds). As a result of the initiative, the medical center has reported improvements in pressure ulcer rates, fewer delays in care, and improved teamwork.<sup>66</sup>

### ***Texas Medical Foundation (QIO)***

The Texas Medical Foundation reported that it made use of the AHCPR guideline and information from Rhode Island Quality Partners (managers of the MedQIC Web site described previously) and participating nursing facilities to implement an improvement initiative in Texas. Measures were those required by CMS and state regulators for nursing facilities. Components of the program included facility-wide education on continuous quality improvement processes, monthly onsite visits and visits on request, a tool kit of interventions, periodic measurements during onsite visits, and a weekly tracking tool with benchmarks against national and state prevalence rates. The tool kit included reference cards for assessment and interventions, color-coded reminders systems indicating mobility needs of at-risk residents, chart stickers for flagging at-risk residents, physician-facility communication forms, care planning tools, and resident and family education brochures.

### ***Country Villa Health Services***

One chain of nursing facilities participating in the AHRQ-sponsored initiative, *On-Time Quality Improvement for Long-term Care*, is Country Villa Health Services, based in Los Angeles, California. The program is designed to streamline daily documentation of resident status and develop weekly reports using information technology. The goals of the program are to improve documentation, to reduce the incidence of facility-acquired pressure ulcers, and to improve staff satisfaction. Certified nursing assistants (CNAs) use digital pens to capture information which is easily accessible real-time in a Web-accessible database. The information collected includes vital signs, activity levels, and other factors helpful in determining risk for pressure ulcers. Facilities can create reports based on resident data which allow them to visualize trends suggesting increased risk. In the first phase of the project, 11 participating facilities achieved a 33% reduction in pressure ulcer prevalence within one year of starting the project. Country Villa’s director of continuous quality improvement commented that the direct care staff expressed greater satisfaction, were more attentive to documentation because it generated more daily feedback on resident care, and were engaged in the quality improvement effort.<sup>67</sup>

### ***Common Themes in Successful Programs***

A number of additional case studies are available on the IHI Web site (e.g., see <http://www.ihl.org/IHI/Topics/PatientSafety/SafetyGeneral/ImprovementStories/>). Common elements in the programs are organizational commitment, a dedicated task force, baseline measurement, unit-level champions, standardized care processes, ongoing feedback to and from frontline staff used as educational opportunities, and ongoing measurement.

Commitment from senior leadership is important both for initiating and sustaining such programs. For example, leaders need to understand the importance of adequately staffed nursing units. A number of

studies have found that a reduction in available nursing staff is associated with an increase in the incidence of pressure ulcers.<sup>6</sup> Making managers accountable, as described in the report from Ascension Health, regular audits of compliance with assessment and interventions, and frequent communication with nursing staff about incidence data serve to integrate the initiative into the organizational culture. While there are many recommendations for risk assessment methods and a variety of ways to implement guideline-based care, a local team of experts working with nursing leaders helps to generate recommendations that make sense for the particular organization.

While experts in wound care provide important input, having unit-based champions who are involved in continuous learning and who become mentors to fellow staff members is also very important in these successful programs. Peer-to-peer encouragement and education, coupled with celebrations of success was frequently mentioned in improvement stories from a number of organizations. All members of the team who care for patients need to be included in the effort, whether they are CNAs in the nursing home or transport workers in the hospital. These individuals can provide useful insights for improving care processes, particularly when they see their input utilized by other members of the team.

## Educational Programs

A number of organizations have made training modules and educational materials available for clinicians. Some of these are listed below.

The American Nurses Association, through its National Database of Nursing Quality Indicators, has made online training modules available on pressure ulcers and staging, other wounds and skin injuries, and collection of data. ([www.nursingquality.org/NDNQIPressureUlcerTraining](http://www.nursingquality.org/NDNQIPressureUlcerTraining))

The National Pressure Ulcer Advisory Panel ([www.npuap.org](http://www.npuap.org)) has some free educational materials and some available for purchase by nonmembers. These include slides on pressure ulcer prevention and on methods for collecting prevalence and incidence data.

The Texas Medical Foundation Web site provides their entire toolkit, which includes educational materials adapted from the NPUAP materials. The slide presentations include a set on the basics of pressure ulcers and another on the basics of prevention.

(<http://nursinghomes.tmf.org/PressureUlcers/PressureUlcerToolkit>)

The Delaware Valley Geriatric Education Center and the Division of Geriatrics of the University of Pennsylvania, with support by a grant from the U.S. Health Resources and Services Administration, produced a variety of educational modules, including one designed for direct care workers in long-term care. The program, Teaching and Learning to Care: Training for Caregivers in Long-Term Care (TLC for LTC), is designed for use by staff educators and includes pre- and post-tests, slides, and instructor notes. ([http://www.nursing.upenn.edu/centers/hcgne/gero\\_tips/TLC/default.htm#intro](http://www.nursing.upenn.edu/centers/hcgne/gero_tips/TLC/default.htm#intro))

The American Medical Directors Association (AMDA) has an online course for physicians on AMDA's Clinical Practice Guidelines for Pressure Ulcers and Pressure Ulcer Prevention.

([www.amda.com/cmefirect/pressureulcers/index.cfm](http://www.amda.com/cmefirect/pressureulcers/index.cfm)) The introduction states that "physicians must not perceive wounds solely as a nursing problem" and that "prevention and managing wounds requires a cooperative, interdisciplinary team effort of members with varying skills."

Several articles in our review addressed education and training of staff.<sup>68</sup> Some studied use of photographs for teaching pressure ulcer recognition, and improving methods for recognizing nonblanching erythema and moisture damage by simple or complex technological solutions.<sup>3,48,69-74</sup> One study presented a program for teaching ICU staff to differentiate pressure ulcers from other skin injuries.<sup>75</sup> Another examined the effect of Web-based training on use of the Braden scale.<sup>76</sup> The authors were surprised to see that nurses previously unfamiliar with the Braden scale and nurses who considered themselves "regular users" of the tool scored similarly on the pre-test. However, the new users improved with the Web-based training, but those who considered themselves already knowledgeable did not. If this were replicated elsewhere, it would certainly need to be considered when designing staff educational programs.

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