

Reducing Hospital-Acquired Pressure Ulcers By Implementing a Skincare Regimen – Evaluating Cost and Outcomes

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“This study demonstrated that the cumulative effect from management changes and implementation of silicone-based dermal nourishing emollient (SBDNE) was important in bringing about a significant reduction in the number of patients with pressure ulcers and respective treatment costs.”

Reducing Hospital-Acquired Pressure Ulcers By Implementing a Skincare Regimen – Evaluating Cost and Outcomes

OBJECTIVES:

The aim of this evaluation was to determine the effect of a silicone-based dermal nourishing emollient (SBDNE) regimen on the reduction of pressure ulcers and costs in a hospital medical unit.

STUDY DESIGN:

- A hospital in the western region of the United States measured hospital-acquired prevalence rates of pressure ulcers in patients from May 2006 to December 2007.
- A retrospective, longitudinal design is used to examine the changes in pressure ulcer prevalence rates and the economic effect of introducing a silicone-based dermal emollient regimen into an existing pressure ulcer prevention protocol.
- A comparison using parametric and non-parametric methods was used to determine statistical differences in the likelihood of hospital-acquired pressure ulcers before and after implementation of SBDNE.
- Cost estimates from the literature are used to estimate the economic impact of pressure ulcer treatment before and after the implementation of SBDNE.

FINDINGS:

- A multi-brand skincare regimen was replaced by a single-brand skincare regimen of products containing SBDNE. After this single-brand regimen was introduced into an existing pressure ulcer prevention program, the incidence of hospital-acquired pressure ulcers fell to 0 percent after 8 months.
- Estimated savings was \$6,676.63 per patient admitted to the medical unit following implementation of the single-brand SBDNE skincare regimen.

REDUCING HOSPITAL-ACQUIRED PRESSURE ULCERS BY IMPLEMENTING A SKINCARE REGIMEN-EVALUATING COST AND OUTCOMES

Objective

The aim of this evaluation was to determine the effect of a silicone-based dermal nourishing emollient (SBDNE) regimen on the reduction of pressure ulcers and costs in a hospital medical unit.

Rationale

Pressure ulcers represent a serious problem for patients within the acute-care setting, and a significant care management challenge for clinicians. Beginning in October of 2008, the Centers for Medicare & Medicaid Services (CMS) will no longer assign a higher DRG for facility-acquired pressure ulcers that develop in the hospital. Formation of pressure ulcers in hospitals also puts institutions at financial risk of lawsuits. It is imperative that hospitals follow evidence-based guidelines and methods to reduce the incidence of these wounds or suffer the economic consequences.

Research Design and Methods

The wound healing center at Porter Adventist Hospital in Denver, Colorado documented the prevalence rate of hospital-acquired pressure ulcer patients in the hospital from May 2006 to December 2007. A retrospective, longitudinal design is used to examine the changes in pressure ulcer prevalence rates and the economic effect of introducing a silicone-based dermal nourishing emollient regimen into an existing pressure ulcer prevention protocol. A time series descriptive comparison and a chi square analysis are used to determine statistical differences in the likelihood of hospital-acquired pressure ulcers before and after implementation of SBDNE. Cost

estimates from the literature are used to compute the economic impact of pressure ulcer treatment before and after the implementation of SBDNE.

Results

A variety of skincare products and brands were replaced with a single-brand SBDNE skincare regimen. This single-brand regimen was introduced into an existing pressure ulcer prevention program. The proportion of hospital-acquired pressure ulcers was significantly reduced to 0 percent after 8 months. Estimated cost savings per patient admitted to the medical unit attributed to SBDNE averaged \$6,676.63 per patient.

Main Conclusions

The cumulative effect from management changes and the implementation of SBDNE skin care was important in bringing about a significant reduction in the number of patients with pressure ulcers and respective treatment costs.

OVERVIEW

According to the Agency for Healthcare Research and Quality (AHRQ), the number of hospital patients who develop pressure sores, also known as decubitus ulcers, pressure ulcers or bed sores, has risen by 63 percent over the last 10 years. Pressure ulcers represent a serious problem for patients within the acute care setting and a significant care management challenge for clinicians. As of October 2008, the Centers for Medicare & Medicaid Services will no longer assign a higher DRG for facility-acquired pressure ulcers that develop in the hospital. The AHRQ found that the average stay for patients

admitted to hospital for treatment of pressure sores was 13 days, with an average cost of \$37,800 per hospital stay.¹ An average acute care hospital will spend between \$400,000 to \$700,000 per year to treat pressure ulcers.² Research also shows that the actual costs on a timeline from creation of the ulcer to complete healing can reach as high as \$90,000.³⁻⁶ Nearly nine of every 10 hospital stays involving pressure ulcers were covered by government health programs – 66 percent by Medicare and 23 percent by state Medicaid programs.¹ Liability is another indirect cost of pressure ulcers. The average malpractice award in 1995 was \$500,000.⁷ The award figure does not include the costs of management time or legal fees incurred by the practitioners or the facility. If one patient in five develops a Stage III or Stage IV pressure ulcer and brings suit, that would add \$2,000,000 in settlement costs to the facility, based on average 1995 malpractice awards.

Pressure ulcer prevention guidelines from the AHRQ and the National Pressure Ulcer Advisory Panel (NPUAP) emphasize the importance of risk assessment, pressure relief, skin inspection, nutritional assessment and documentation of each and every step of a comprehensive program to have the best chance of preventing pressure ulcers and the economic consequences.⁸ The effect of a comprehensive program has demonstrated a significant reduction in pressure ulcers in nursing homes.⁹

Maintaining skin integrity is a critical factor for reducing the risk of pressure ulcers. Alterations in skin integrity can be caused by multiple factors, including pressure, friction, shear, moisture and compromised physical, psychosocial and nutritional states. Any alteration in skin integrity may cause unique and complicated skin reactions. Recognition of predisposing factors and early intervention will reduce or eliminate the impact. Many commercial products exist to improve skin

integrity and protect against factors that produce pressure ulcers. One skincare program (Remedy™, Medline Industries, Inc., Mundelein, Illinois) is silicone-based and utilizes dermal emollients. For the purposes of this paper, this skincare program is referred to as the SBDNE program or regimen. The SBDNE regimen contains a proprietary blend of antioxidants, amino acids, vitamins (A, B₃, B₆, C and D₃) and methylsulfonylmethane (MSM).¹⁰ Each of these ingredients has been well researched for its role in basic cellular reconstruction and protection.

Scientific Merit for SBDNE

Clinical research for SBDNE demonstrates the ability to ameliorate skin conditions, such as in lymphedema-affected skin, ichthyotic skin and skin affected by poor lower limb circulation.¹¹⁻¹³ The specialized nutrients, for example, modulate biochemical abnormalities associated with pruritus.¹¹ The mechanism through which the SBDNE line prevents pressure ulcer formation is yet to be definitively confirmed, but it is believed that the capacity of the product range to keep skin moist and hydrated may have a major contributory effect.¹⁴ Local episodes of perfusion blockage and reperfusion are known to lead to an exuberant presence of reactive oxygen species. Free radicals, which lead to below-the-surface tissue damage, may “open out” to pressure ulcer episodes.¹⁵⁻¹⁸ It is possible that the antioxidant nature of potent anti-oxidative ingredients (such as hydroxytyrosol) prevents reactive molecular species damage to tissue, which in turn leads to a decrease in pressure ulcer conditions and rates. In addition, the role of dimethyl sulfoxide (DMSO) in wound healing and as an anti-inflammatory drug has been probed.¹⁹ The SBDNE range contains methylsulfonylmethane, a close chemical relative to DMSO, and it is possible that a similar anti-inflammatory role, leading to pressure ulcer reduction, may be played by the methylsulfonylmethane molecule.

Hospital Challenge

In 2006, the Porter Adventist Hospital made changes to their management team in order to provide improved care to patients, and they specifically decided to target a reduction in pressure ulcer rates. Staff training was refocused to provide better patient care. As a consequence of these steps, hospital-acquired pressure ulcer rates began to decline. However, the staff considered the rates to be amenable to further reduction. Since they had made changes in all aspects of their program except for skincare products, they decided to target their skincare program next to determine the impact on their comprehensive program.

Thus, from January 2007, the WOCN nurses began to look at pressure ulcer prevalence data, focusing on patient risk factors for skin breakdown. It was discovered that all patients in the medical unit with skin breakdown were also incontinent. A mixture of skincare products and brands was being used with no particular thought paid to synergy or effectiveness (or lack thereof) amongst these diverse products. When making a choice in implementing a consistent skincare program to bring down pressure ulcer rates below the national average, the SBDNE skincare product line was chosen by the wound care team. The decision was based upon their analysis that this regimen reflected the latest technology and that the product range was formulated to enhance skin improvement effects in a synergistic fashion, i.e., products that would protect intact skin as well as treat raw, denuded skin. A protocol for appropriate use of the products was drafted and in-serviced to the medical unit staff. No other measures were taken to reduce pressure ulcers at the time the skincare product change took place.

Experimental Approach

This study aims to estimate the economic impact of switching from a variety of skincare products to a

systematic product regimen including SBDNE to prevent hospital-acquired pressure ulcers. It was believed that the hospital would save on treatment costs and the potential financial implications of lawsuits through the reduction of pressure ulcers in a medical unit. Data was collected to determine if this premise would hold true.

METHODS

In 2006, the Porter Adventist Hospital wound healing center initiated the collection of pressure ulcer incidence and prevalence data in their hospital. Data collection forms and instruction were provided by Kinetic Concepts, Inc., San Antonio, Texas. Data was collected on a quarterly basis and the prevalence rates were quantified each quarter. Additional information regarding patient risk on admission, hospital policy changes and pressure ulcer prevention procedures in the medical unit was also measured.

A time-series analysis was used to show the changes in prevalence rates from first data collection in May 2006 through December 2007. Prevalence rate (the measure of the proportion of patients who have a pressure ulcer in each quarter) was charted. A chi square analysis was used to determine statistical differences in patient risk for pressure ulcers and the proportion of pressure ulcers acquired between the periods before implementation of the SBDNE regimen and after.

The Braden Scale for Predicting Pressure Sore Risk scores were obtained from the hospital for all patients included in the pre-SBDNE and post-SBDNE groups. The Braden Scale was the tool used to assess six risk areas (subscales) for developing pressure ulcers: sensory perception, skin moisture, activity, mobility, nutrition and friction/shear. Each subscale within the Braden Scale contains a numerical range of scores, with 1 being the lowest score possible. The

friction/shear subscale ranges from 1 to 3; the other subscales range from 1 to 4. All risk areas are then added and the total overall risk, ranging from 6 to 23, is determined. In the medical unit, scores at or below 16 were used to indicate high risk while scores above 16 were determined to indicate moderate to no risk. For purposes of this evaluation, the cut-off point for patients at risk of pressure ulceration is 18 or below. We also stratified the risk according to a broad outline of protocols by risk level and measured statistical differences between the two periods.²¹

The risk for acquiring pressure ulcers in hospital increases with age.²² Approximately 70 percent of all pressure ulcers occur in persons older than 70 years.²³ An independent t-test for equality of means compared the pre-SBDNE and post-SBDNE periods for differences in patient age.

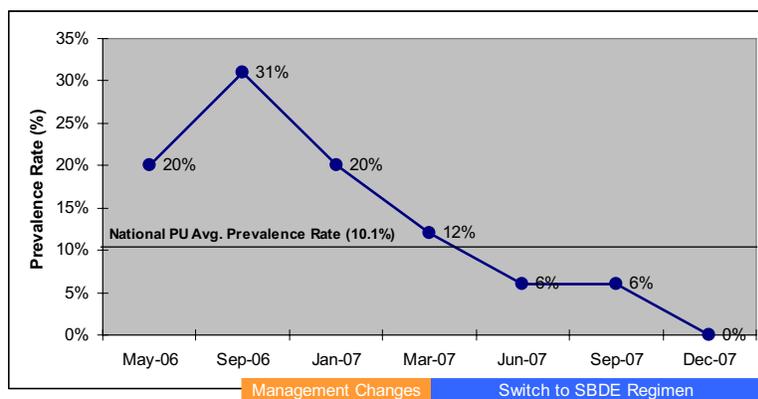
Costs of pressure ulcer treatment can vary dramatically depending on the severity of the wound and complications. Average costs of treatment for pressure ulcers in an acute care setting, published by the Agency for Health Care Research and Quality, were used to estimate the economic consequences with these study results. Skincare product costs and resources used to administer pre-SBDNE and post-SBDNE were not included in the economic analysis. The direct costs of prevention are assumed to be similar pre-SBDNE and post-SBDNE. The only change was the implementation of SBDNE products for skin care.

RESULTS

Time-Series, Prevalence Rates

The pressure ulcer prevalence rate reached a high of 31 percent for the quarter ending September 2006 when the decision was made to initiate a pressure ulcer prevention study and to measure the results. The Kinetic Concepts form was used to document data collected throughout the study. Pressure ulcer prevalence rates dropped an average of 10 percent after new management-implemented staffing changes in October 2006. Additional measures were implemented that further dropped the prevalence rate to 12 percent in March 2007. But leadership believed that further reductions could be achieved through a change in the skincare protocol. Up until this point, no changes had been made in the skincare products that were being used in the medical unit. It was decided to change to a silicone-based dermal nourishing emollient regimen for skin care at this time. Prevalence rates immediately began to drop below the national average of 10.1 percent (Figure 1) and in December of 2007, over a seven-month period, the hospital medical unit experienced a 0 percent prevalence rate for pressure ulcers.

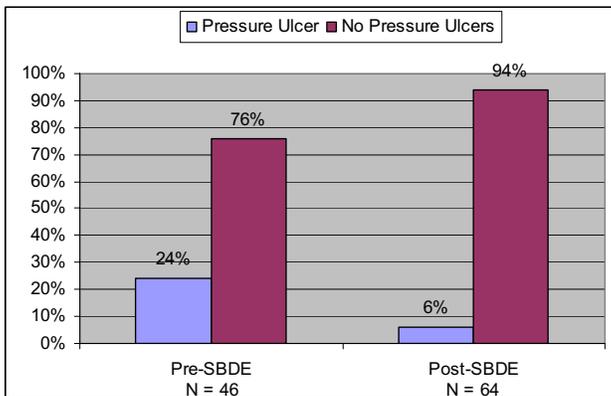
Figure 1, Longitudinal Time-Series, Prevalence Rates for Medical Unit



Statistics

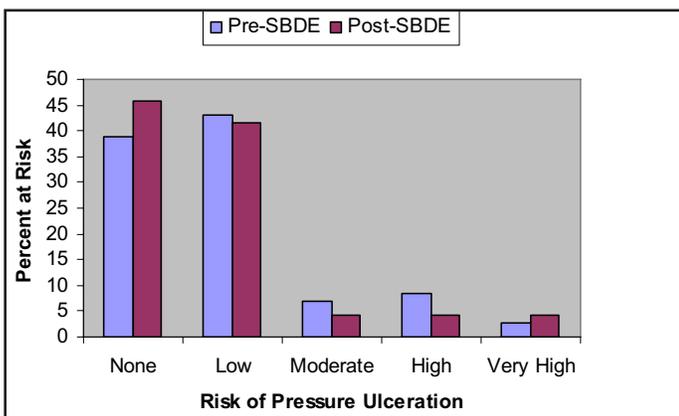
A chi-square analysis was used to determine statistical differences between the proportion of hospital-acquired pressure ulcers before the SBDNE regimen was implemented and after. Figure 2 shows proportional differences in hospital-acquired pressure ulcers from pre-SBDNE to post-SBDNE. A significant difference in the likelihood that a patient will develop a pressure ulcer exists between the pre-SBDNE program and post-SBDNE program ($\chi^2 = 7.09$, $DF = 1$, $p = .008$).

Figure 2, Likelihood of Acquiring a Pressure Ulcer in Medical Unit



In Figure 3, patients had the same predictive risk profile for pressure ulceration in both time periods as determined by a cut-off Braden Scale score of 18 and stratified prevention protocols by risk level ($\chi^2 = 1.64$, $DF = 4$, $p = .801$).

Figure 3, Patient Risk for pressure Ulcers in the Medical Unit



There were no significant differences in the ages of patients admitted to the medical unit during the evaluation period (Table 1). The average age is 68.65 and 67.81 for the pre-SBDNE and post-SBDNE patients, respectively.

Table 1, Age as a Factor for Pressure Ulcer Occurrence

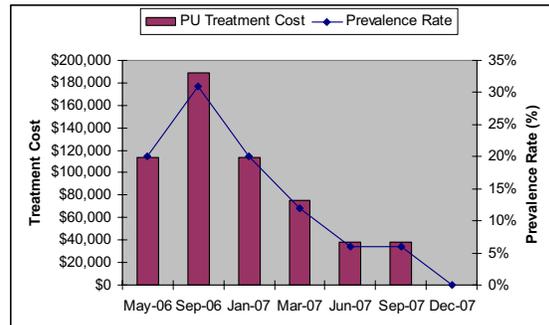
Group	N	Mean	Std. Deviation	Std. Error
Pre-SBDNE	46	68.65	18.109	2.105
Post-SBDNE	64	67.81	17.541	2.532

t-test for Equality of Means (two-tailed significance, $P = .801$)

Average Cost Savings

Figure 4 shows the estimated cost of pressure ulcer treatment by quarter from May 2006 to December 2007. Costs are reduced first by changes in hospital management (October 2006–March 2007) and associated improvements in training, nursing practices and nurse/supervisor interactions.

Figure 4, Estimated Cost of Pressure Ulcer Treatment by Quarterly Prevalence Rates



Secondarily, a drop in the number of patients with hospital-acquired pressure ulcers was observed during the SBDNE period (April 2007–December 2007), producing a further cost savings for the hospital. The average cost savings produced by switching to the SBDNE regimen is estimated at \$6,676.63 per patient admitted to the medical unit and is summarized in Table 2 (Next Page).

Table 2, Estimated Cost Savings from SBDNE Skin Care Regimen

	Baseline	Management Changes		SBDNE Implementation			
	May 2006	September 2006	January 2007	March 2007	June 2007	September 2007	December 2007
Number of Patients	15	16	15	17	16	17	14
Number with Pressure Ulcers	3	5	3	2	1	1	0
Estimated Hospital Cost for Treatment (# x \$37,800)	\$113,400	\$189,000	\$113,400	\$75,600	\$37,800	\$37,800	0
Total Costs	\$415,800.00			\$151,200.00			
Total Cost Savings				\$264,600.00			
Average Cost of Pressure Ulcer Treatment per Admitted Patient in the Medical Unit	\$9,039.13			\$2,362.50			
Average Cost Savings per Admitted Patient in the Medical Unit				\$6,676.63			

Savings are directly related to the development of pressure ulcers. The cost of SBDNE products was not included in this analysis, but it is assumed that skincare product cost is much lower than the cost of treating pressure ulcers. Nurses at the medical unit were already applying a mixture of skincare products to patients before switching to the new SBDNE regimen.

In addition to reduced costs from treating pressure ulcers, the hospital has reduced the probability of lawsuits with reduced prevalence. Settlement costs for a hospital-acquired pressure ulcer can be as high as \$2,000,000, according to published industry reports.

Discussion

There are many factors associated with pressure ulcer formation in vulnerable hospital patients. This paper clearly demonstrates the importance of skin care, and especially the use of synergistic products with a formulation that has been developed to promote basic cellular reconstruction and protection of damaged skin. Skincare products must also be easy to apply and remove, if necessary.

New hospital management clearly had an early impact on pressure ulcer prevalence rates by focusing nursing time on prevention. This evaluation also suggests

that SBDNE skincare products lead to cost savings when added to an existing pressure ulcer prevention program. The average cost savings attributed to the SBDNE products is estimated at \$6,676.63 per patient. Indirect costs from liability were not included in the cost savings estimate but could be as high as \$2,000,000 per occurrence.

With October 2008 approaching, Porter Adventist Hospital is moving in the right direction to reduce the prevalence of hospital-acquired pressure ulcers. Beginning in October 2008, Medicare will not reimburse at a higher DRG for the treatment of such ulcers unless they were present on admission. It is imperative that all hospitals use best practices and evidence-based products to avoid skin breakdown.

Limitations and Assumptions

There are many factors associated with pressure ulcer formation in vulnerable hospital patients. This paper clearly demonstrates the importance of skin care, and especially the use of synergistic products with a formulation that has been developed to promote basic cellular reconstruction and protection of damaged skin. Skincare products must also be easy to apply and remove, if necessary.

Implications/Significance of the Evaluation

Clinical observation of outcomes is an important factor when considering the use of healthcare products and services. In this evaluation, the clinical input supports the use of SBDNE products in the medical unit as the major factor for pressure ulcer reduction. Changes in management at the hospital had clearly produced some early, positive results. The continued results following implementation of the SBDNE skincare protocol validates clinical intuition. Clearly there was a remarkable reduction in prevalence rates after SBDNE implementation. With respect to forthcoming Medicare and Medicaid reimbursement changes (<http://www.cms.hhs.gov/HospitalAcqCond/>), it is imperative for hospitals to reduce the prevalence of hospital-acquired pressure ulcers. The replacement of various skincare products and brands with SBDNE skincare products and introducing them into an existing pressure ulcer prevention program at Porter Adventist Hospital reduced the prevalence rate from 12 percent at the time of change to 0 percent.

Focus on skin care by the nursing staff did not change prior to or after SBDNE implementation. The change came with sequential and methodical use of SBDNE products as directed by product indication and protocol established at the hospital. It seems clear that the introduction of a comprehensive program, including the introduction of the new skin-care regimen, played a role in reducing pressure ulcer levels at a remarkable rate.

Conclusion

The cumulative effect from management changes and implementation of a silicone-based dermal nourishing emollient regimen were important in bringing about a significant reduction in the number of patients with pressure ulcers. The overall effect is very similar to results published by Lyder et al, where a change in

management philosophy and a comprehensive pressure ulcer prevention program produced a significant reduction in pressure ulcers for at-risk nursing home residents.⁹ At Porter Adventist Hospital, the cost savings attributed to SBDNE is estimated at \$6,676.63.13 per patient in the medical unit. There is a statistically significant difference in the proportion of hospital-acquired pressure ulcers between pre-SBDNE and post-SBDNE implementation given the same comprehensive prevention program ($p = .008$).

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References

1. Agency for Healthcare Research and Quality. Number of Patients with Pressure Sores Increasing. Available at: <http://www.medscape.com/viewarticle/533868>. Accessed May 13, 2008.
2. Robinson C, Gloecker M, Bush S et al. Determining the efficacy of a pressure ulcer prevention program by collecting prevalence and incidence data: a unit-based report. *Ostomy Wound Management*. 2003;49(5):44-51.
3. Rees RS, Bashshur N. The effects of telewound management on use of service and financial outcomes. *Telemedicine and e-Health*. 2007;13(6): 663-674.
4. Allman RN, Laprade CA, Noel LB et al. Pressure sores among hospitalized patients. *Ann Intern Med*. 1986;105:337-342.
5. Kerstein M, Gemmen E, van Rijswijk L. Cost and cost effectiveness of venous and pressure ulcer protocols of care. *Dis Manage Health Outcomes*. 2001;9:651-663.

6. Alterscu V. The financial costs of inpatient pressure ulcers to an acute care facility. *Decubitus*. 1989;2:14-23.
7. Beckrich K, Armovitch S. Hospital-acquired pressure ulcers: a comparison of costs in medical vs. surgical patients. *Nursing Economics*. 1999;17(5):263-271.
8. Pressure Ulcers in Adults: Prediction and Prevention. Clinical Practice Guideline Number 3. AHCPR Pub. No. 92-0047, May 1992.
9. Lyder CH, Shannon R, Empleo-Frazier O et al. A comprehensive program to prevent pressure ulcers in long-term care: Exploring costs and outcomes. *Ostomy Wound Management*. 2002;48(4):52-62.
10. Fleck CA, McCord D. The dawn of advanced skin care. *Extended Care Product News*. 2004;95(5):32,34-39.
11. McCord D, Fore J. Using Olivamine-containing products to reduce pruritic symptoms associated with localized lymphedema. *Advances in Skin and Wound Care*. 2007;20(8):441-445.
12. Fleck C. Managing ichthyosis: a case study. *Ostomy Wound Management*. 2006;52(4):82-93.
13. Driver V et al. A Randomized Open Controlled Pilot Study of the Use of Remedy NutraShield with Olivamine™ Vs Xenaderm™ in the Maintenance of Newly Epithelialized Skin of Lower Extremity of Ulcers. Symposium of Advanced Wound Care, Tampa, 2007.
14. McCord D. Using Remedy NutraShield to prevent transepidermal water loss. *Medline Technical Bulletin*. 2004:1-4.
15. Grisotto PC, dos Santos AC, Coutinbo-Netto et al. Indicators of oxidative injury and alterations of the cell membrane in the skeletal muscle of rats submitted to ischemia and reperfusion. *J Surg Res*. 2000; 92(1):1-6.
16. Houwing R, Overgoor M, Kon G et al. Pressure-induced skin lesions in pigs: reperfusion injury and the effects of vitamin E. *J Wound Care*. 2000; 9(1):36-40.
17. Mustoe T. Understanding chronic wounds: a unifying hypothesis on their pathogenesis and implications for therapy. *American J Surg*. 2004;187 (5A):65S-70S.
18. Loerakker S. Aetiology of Pressure Ulcers, Biomechanics and Tissue Injury, 2007; Eindhoven University of Technology. Available at: www.mate.tue.nl/mate/pdfs/8628.pdf. Accessed May 12, 2008.
19. Duimel-Peeters IGH, Houwing RH et al. A systematic review of the efficacy of topical skin application of dimethyl sulfoxide on wound healing as an anti-inflammatory drug. *WOUNDS*. 2003;15(11):361-370.
20. Bergstrom N, Braden B, Kemp M, Champagne M, Ruby E. Predicting pressure ulcer risk: a multisite study of the predictive validity of the Braden Scale. *Nursing Research*. 1998;47(5):261-269.
21. Braden Scale for Predicting Pressure Sore Risk. Available at: www.bradenscale.com/newlevels.htm. Accessed May 13, 2008.
22. Perneger TV, Héliot C, Raë A, Borst F, Gaspoz JM. Hospital-acquired pressure ulcers: risk factors and use of preventive devices. *Arch Intern Med*. 1998;158:1940-1945.
23. Roundtable discussion on pressure ulcer prevention. Chicago, IL; February 2, 2008.