



# Wound Bed Preparation

## It's About TIME

Attention to underlying wound etiology and factors that affect healing, combined with the TIME Principle for Wound Bed Preparation, can be a powerful model for healthcare providers who manage patients with chronic wounds. Wound bed preparation is an important part of the care process, as is the ability to evaluate and benchmark the effectiveness of individual treatment modalities and the overall quality of care provided within a facility. In addition, assessing performance can fuel a facility's outcomes-based quality improvement (OBQI) program and the ability to benchmark with others can help a facility achieve "best practice" status.

The cyclical series of events that comprise benchmarking involve documentation of information, assessing performance and comparing outcomes with peer facilities, sharing information, and implementing changes in order to improve quality of care. Benchmarking has been shown to be one of the most effective tools for fostering the adoption of best practices. Implementing a wound bed preparation program that incorporates the best practices inherent in the TIME model can enhance the benchmarking process.

This is the final article of a 12-part series on wound bed preparation.



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## The Problem — How to Determine whether Desired Outcomes Have Been Achieved

**Prognostic factors.** Aspects of wound condition managed according to the TIME principle have a direct impact not only on the progress of that particular wound characteristic (tissue, infection/inflammation, moisture, and edge of wound) but also on the final outcome. In addition, a number of factors (eg, wound duration and patient comorbidities) noted at initial presentation (*baseline characteristics*) have been demonstrated to affect healing (see Table 1). In particular, baseline wound area has been shown to correlate with time to closure.<sup>1-3</sup> How can baseline wound characteristics such as area help determine appropriate healing benchmarks?

## The Solution – Establishing Appropriate Benchmarks

**Generating benchmarks.** Establishing a data set that allows the user or healthcare provider to systematically examine the effects of prognostic factors is inherent to the benchmark process. Examples of healing benchmarks that take into account the baseline area of the wound include:

- \* Percentage of wounds healed by week 12 (bar chart)
- \* Percentage of wounds healed through time (Kaplan-Meier plot)
- \* Probability of healing at 12 weeks (logistic regression) (see Figures 1 through 3).

Benchmarks presented in this article were derived using a data set of 545 patients with 1,137 venous stasis ulcers. These data were provided by users of the WoundPath® Clinical Documentation and Outcomes Management System (Bamboo, a division of Smith & Nephew, Largo, Fla) (see Data collection, page 3) and represent a real world picture of a patient population in US outpatient wound clinics. The patient, wound, and treatment level data presented here are extracted from a data set of patients who presented to clinics over a 2-year period (ulcer size ranging in area from 0.1 to >50 cm<sup>2</sup>). Standard statistical techniques for logistic regression were used to compare the relative performance of the participating clinics.

**Bar chart.** The bar chart in Figure 2 shows that the percentage of wounds healed after 12 weeks decreases as initial area increases. It is important to note that outpatient wound clinics often serve patients with hard-to-heal wounds that have failed to respond to acute therapies or general practice guidelines. The effect of baseline area is clear — the percentage of wounds >10cm<sup>2</sup> healed at 12 weeks is about half the percentage of wounds of <2 cm<sup>2</sup> healed in the same period.

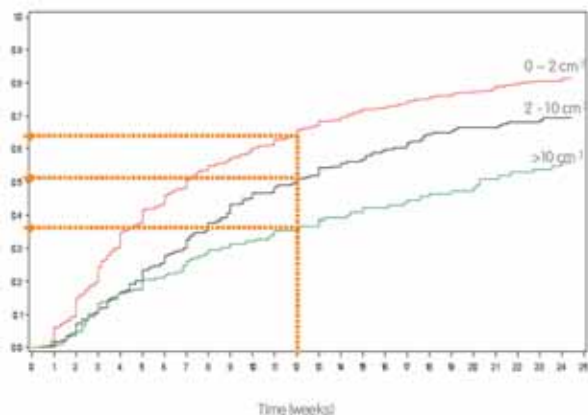


Figure 2a. Probability of healing at 12 weeks.

### Wound Factors

- Wound Area
- Duration
- Location of Wound
- Level of Exudate
- Wound Bed Slough & Eschar
- Erythema
- Oedema
- Wound Debrided
- Recurred Wound
- Infection

### Patient Factors

- Age
- Gender
- Height
- BMI
- Hypertension
- Diabetes
- Patient Mobility
- Ankle Mobility
- Venous Stripping/Ligation
- DVT

Table 1. Prognostic factors in patients with venous leg ulcers.

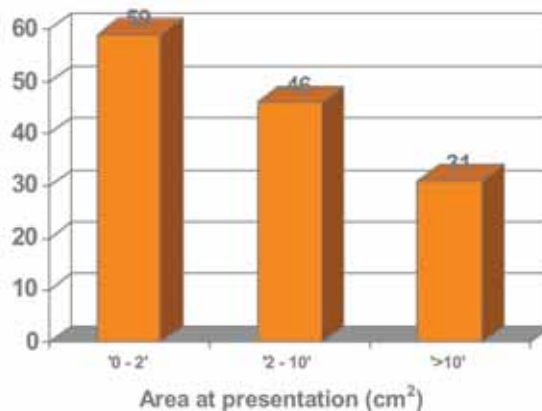


Figure 1. Percent of wounds fully healed at 12 weeks.

**Kaplan-Meier plot.** This Kaplan-Meier plots (see Figures 2a, b) demonstrate the healing probability of wounds of different baseline areas through time. Again, the impact of baseline area on healing is apparent and points to the need to set different benchmarks for wounds with different baseline areas. The Kaplan-Meier plot allows healthcare providers to view data in two ways. One interpretation takes into account the time in which wounds within a given size range will achieve a 50% probability of healing (also the time by which 50% of that group should have healed). Thus, 50% of the smallest wounds (0.1 to 2 cm<sup>2</sup>) were healed at 42 days with time to healing increasing with wound size.

The other interpretation considers the probability of wounds of different baseline sizes (or a percent of that group) healing by a specific time point (for example 12 weeks or 84 days) and allows the

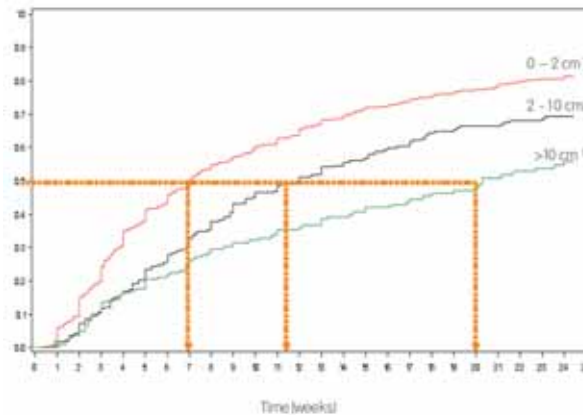


Figure 2b. Time to heal 50% of wounds.

clinician to make comparisons between baseline area categories. In the case presented (see Figure 2b), approximately 44% of the largest wounds, almost 60% of the mid-sized wounds, and more than 70% of the smallest wounds healed.

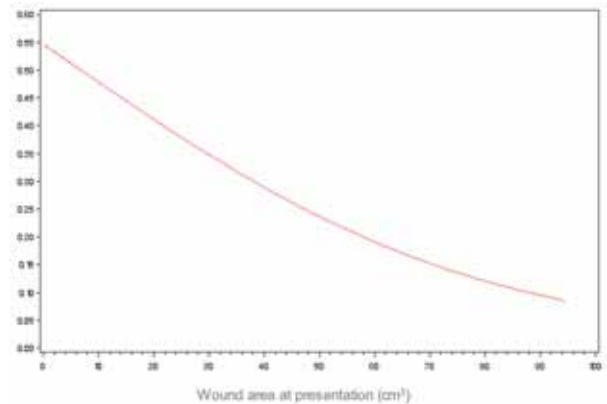
**Logistic regression.** One final representation used in the prognosis and management of a wound is probability of healing (in this case at 12 weeks) for an individual wound based on a specific baseline area (see Figure 3). The probability of healing by 12 weeks reduces with an increase in wound area at presentation. As is common practice, patients receiving palliative care were excluded from the data set used in this setting. The results of this analysis reinforce the need to consider wound area at presentation as well as the effectiveness of interventions on wounds of specific etiologies when evaluating the prognosis of a given wound. It also underscores the need for careful consideration of baseline area when developing benchmarks and evaluating facility performance and wound outcomes.

**Benchmarking relative clinical performance.** Relative clinic performance can be examined using logistic regression methodology. The relative odds of achieving wound closure at 12 weeks in each clinic are determined by taking baseline wound area into account. An odds ratio was calculated that compared five facilities for the outcome “healed” or “not healed” at 12 weeks (see Figure 4). Clear differences in clinic performance are observed — eg, the odds of healing in wound care center 5 were significantly better than in other clinics. Clarification of the drivers of such differences is a future priority for such analysis programs and should focus on data gathered on additional prognostic factors (at both patient and wound level) as well as on clinical practice and treatment regimens.

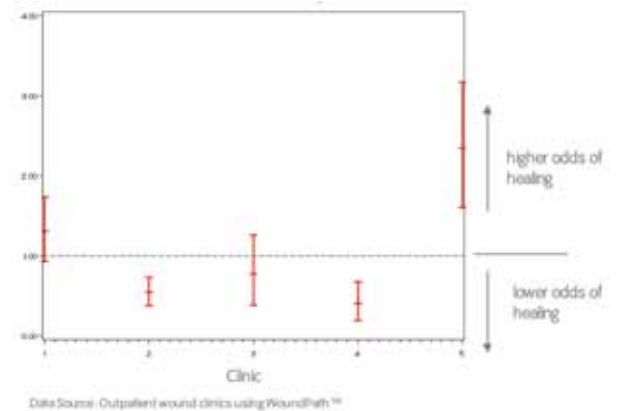
**Benchmarking for performance management.** Much has been written about the importance of performance management that is enhanced by adopting processes to drive continuous clinical outcomes improvement. In 1994, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) introduced new standards for improving organizational performance, shifting from a focus on individuals to a focus on processes. Benchmarking as a process can be used to determine relative performance of providers compared to others or to an established target. The process can uncover the drivers of better clinical outcomes and the practices that need improvement.

**The Six Sigma strategy.** Important aspects of benchmarking include accurate documentation of patient and wound information; applying a robust process for collecting, reviewing, and analyzing information; exchanging and re-evaluating information; and reviewing differences in processes and protocols. One approach to benchmarking involves the Six Sigma strategy for process change — identification (to recognize and define the issues), characterization (to measure and analyze), optimization (to improve and control) and institutionalization (to standardize and integrate) to drive performance improvements.<sup>4</sup> The analysis presented here examined one of several parameters that have been shown to affect wound healing outcomes; further study is required to examine additional factors. Clinics or healthcare providers who benchmark performance relative to other clinics (to the aggregate performance benchmark) and to preceding time periods with the intent of modifying clinical practices and behaviors are more likely to attain the greatest benefits, particularly with respect to evaluating the effectiveness of their efforts in wound bed preparation.

**Data collection.** Data from the study reported here was collected using WoundPath® software, which allows the capture of key elements of data on wound assessment, treatment, and status through time. Data quality is an essential consideration when analyzing results; use of pre-defined drop-down lists and definitions helps ensure accuracy and consistency. The data presented



**Figure 3.** Probability of complete healing at 12 weeks.



**Figure 4.** Benchmarking relative clinic performance — likelihood of healing at 12 weeks.

here were supplied by US-based outpatient wound clinics associated with a hospital. Data are supplied by each facility on a monthly basis; data aggregation facilitates comparison of previous and current facility performance (outcomes) as well as comparison to other facilities.

**About Bamboo.** Bamboo ([www.bamboohealth.com](http://www.bamboohealth.com)) is an independently operating business unit established by Smith & Nephew's Wound Management Division. The unit was formed to help address many of the issues today's healthcare providers face in managing the delivery of care to patients with wounds.

## Conclusion

By combining Smith & Nephew's extensive wound management knowledge and clinical process understanding with skills in information management, Bamboo offers a program that allows clinicians to derive demonstrable benefit from documenting and assessing clinical and financial outcomes. This program enhances clinician/facility ability to benchmark the impact of wound healing models such as the TIME principle and to improve patient care.

## References

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