Collect Data, Tell Stories: Utilizing Available Data to Improve Wound Product Selection, Reduce Costs, and Improve Outcomes

Eliot Mostow,¹ Jon D. Montemayor,^{1,2} Sean Pittinger,^{1,3} Stephanie Miller,^{1,*} Kimberly N. Blasiolo,¹ and Judith Fulton¹

¹Wound Healing and Limb Preservation Center, Akron General Medical Center, Akron, Ohio.

²Department of Biology, The University of Akron, Akron, Ohio.

³Department of Mathematics, Boston College, Chestnut Hill, Massachusetts.

Stephanie Miller, BA

Submitted for publication July 2, 2013.

*Correspondence: Stephanie Miller, BA, Wound Healing and Limb Preservation Center, Akron General Medical Center, 400 Wabash Ave., Akron, OH 44307 (E-mail: stephannie.miller4@akrongeneral.org)

Objective: To develop a tool to assist in the evaluation of treatment options based on clinically relevant parameters, thus enabling clinicians to heal patients more efficiently.

Approach: Outlined here is the prototypic model of a comprehensive analysis tool to compare products by category, accounting for product characteristics, effectiveness data from literature, costs, and patient needs or clinician preferences.

Results: The tool is demonstrated with a venous leg ulcer example, and ideas for expanding the tool in the future are provided.

Innovation: Although this is a simple model, the authors believe that it provides a valid and useful platform for comparing similar products of a given type using available information and reflecting real-world use to give a practical approach to clinical decision-making.

Conclusion: Future funding for comprehensive, comparative effectiveness studies should provide clarity on which products to choose for specific applications. Meanwhile, tools like this can provide guidance, and can be modified to accommodate varying circumstances.

INTRODUCTION

CLAIRVOYANCE WOULD BE useful in many areas of our lives from making smart investments to avoiding flat tires. However, what if we could predict the costs and benefits of various wound care products and the likelihood of a patient's wound(s) being healed 12 weeks from when we first saw them? Wound clinicians attempting to heal more patients in less time require tools to assist in evaluation of treatment options based on clinically relevant parameters. The broad goal of this project is to create and maintain a current, comprehensive analysis tool to compare products based on literature

reports of efficacy, duration of product effectiveness, frequency of use and costs. Outlined here is a prototypic model used with a venous leg ulcer example and ideas for expanding the tool in the future.

CLINICAL PROBLEM ADDRESSED

Matching the needs of a wound to the characteristics of a product is the ultimate goal. Various wound product formularies have been developed (for example, National Health Service Tayside Wound Management Formulary,¹ or The Joint Wound Management Formulary²), which list selected products according

to evidence-based guidelines by parameters, including treatment indication, product size, and cost. While formularies can facilitate cost-effective prescribing, they have been criticized as lacking flexibility and impeding choice.³ Therefore, numerous products with similar properties, but varying costs and reimbursement should be evaluated. This led the authors to conceptualize an interactive tool to compare products by category, accounting for product characteristics, effectiveness data from literature, costs, and patient needs or clinician preferences. The project was nicknamed “apples-to-apples” to emphasize the goal of equalizing product parameters to standardize comparisons.

MATERIALS AND METHODS

We collected wound product information from the literature and product websites. These data were utilized in a spreadsheet to build a tool that contained both static and variable parameters. The static parameters include product characteristics such as composition, product size, absorbency, adhesiveness, conformability, shelf life, recommended frequency of application, healing rates, costs, reimbursement information, and the level of evidence to support the associated data points. Next, incorporating information responsive to each patient's and clinician's specific needs (variable parameters) creates a more meaningful comparative product tool. These variable fields include the number of product applications, duration of care, number of non-application visits, and number of product applications outside the clinic. The model was tested based on available data and interviews with the wound clinicians regarding parameters they identified as important in caring for patients.

Preliminary static data input allows for comparisons between product characteristics and first-level calculations (Table 1) of cost per cm² based

Table 2. Example first-level calculations using biologic products

Product name	Apligraf®	Oasis® wound matrix	Dermagraft®
Cost per unit ^a	\$1,704	\$91	\$1,590
Sheet size (cm ²)	44	10.5	38
Cost per cm ²	\$39	\$9	\$42
Cost per week	\$568	\$46	\$795
Cost per month (4 weeks)	\$2,272	\$184	\$3,180
Cost for duration of care	\$6,816 ^b	\$546 ^c	\$9,540 ^c

^aCost is based on a review of local hospital invoices done April, 2013.

^bModeled using four applications over 12 weeks duration of care.

^cModeled using six applications over 12 weeks duration of care.

[Example: for Apligraf, \$1,704 × 4 applications per 12 weeks = \$6,816 for duration of care. N.B. cost/week = cost for duration/12].

on the product size, and cost per week based on recommended product applications. Cost data were obtained from hospital invoices to allow calculations of cost per unit and cost per cm². *Cost per week* is calculated using the *mean cost per unit* and multiplying by *product applications per week*. The *cost for duration of care* is the *cost per week* multiplied by the *number of weeks* the practitioner anticipates for treatment (a variable field). Thus, first-level calculations permit comparisons of product factoring duration of care or surface area.

Expanding on the first-level calculations, the model was further modified to consider *cost per 1% patients healed* (Table 1). This second-level calculation is defined as the variable input *duration of care* times *cost per week*, divided by the *percentage of patients healed* as reported in the literature.

RESULTS

An example of using first-level calculations can be seen in Table 2 with three commonly used biologic products: Apligraf® (Organogenesis, Inc., Canton, MA), Dermagraft® (Shire Regenerative Medicine, San Diego, CA), and Oasis® Wound Matrix (Healthpoint Biotherapeutics, Fort Worth, TX). To model costs over 12 weeks (a commonly used timeframe), we surveyed the local clinicians as to their common use of each of these products. For example, although the manufacturer's recommendations for each of the biological products are to apply once per week, this is often more frequent than our practitioners indicated as their usual clinical use. Thus, we used four Apligraf, six Oasis Wound Matrix, and six Dermagraft per 12-week period to calculate the cost for duration of care. This choice of use is obviously dynamic and can be easily modified.

An example of a second-level calculation can be seen in Table 3 using the biologic products. Data for

Table 1. Calculations

Calculations	Definition/comments
First level	
Cost per unit	Cost per box/number of units per box
Cost per cm ²	Cost per unit/sheet size (cm ²)
Costs per week	(Cost per unit × number of applications)/duration of care
Cost per month	Cost per week × 4
Cost for duration of care	Cost per week × duration of care
Second level	
Cost per 1% patients healed	Cost for duration of care/percentage of patients healed (as reported in the literature). Calculations use the whole percentage number (i.e., division by 30, not 0.3).

the percentage of ulcers healed over a period of 12 weeks were obtained from pivotal randomized clinical trials found in the literature.⁴⁻⁹ When the cost for 12 weeks of treatment is divided by the percentage of patients healed in 12 weeks, this gives a cost per 1% patients healed. Using Apligraf as an example in the context of a venous leg ulcer and four applications over 12 weeks, cost for duration of care is \$6,816 as determined in first-level calculations. Falanga and Sabolinski reported a healing rate of 40% for venous ulcers, which is shown in the table as percentage of patients healed.⁴ This allows for the calculation of cost of 1% patients healed, which divides cost for duration of care (\$6,816) by the percentage of patients healed (40%) to give \$170. On the other hand, if the manufacturer's recommendations are followed (one application per week), the cost for 12 weeks would be \$20,448, which translates to \$511 per 1% patients healed.

DISCUSSION

Ideally, comprehensive comparative effectiveness studies would provide standardized outcomes; however, in currently available efficacy studies, products are generally trialed individually against a standard of care rather than to each other, or only a handful of products are tested. To standardize calculations to allow comparisons between studies, percentages of patients healed within a given time frame were included in the spreadsheet. However, utilizing pivotal trials in the literature to compare the percentage of patients healed is a method that assumes patients in the clinic are similar to the inclusion and exclusion criteria used in the reported clinical trial. In addition, a clinician must be able to make an accurate estimation of duration of care to realistically calculate cost comparisons. One disadvantage is the exclusion of ancillary costs,

KEY FINDINGS

- With the multitude of wound products available to clinicians, comprehensive tools to assist in decision-making are valuable for optimal and cost-effective outcomes.
- A tool incorporating evidence-based healing rates, costing information, and responsiveness to clinician practice to meet this need in a unique way.
- This base model allows for continuous improvement as needs and capabilities change, with future iterations of the tool conceptualized around cloud computing and increased customizability.

secondary dressings, and additional required supplies, which contribute to the overall cost of some treatment modalities. In addition, the perspective of this discussion is a hospital-based outpatient clinic, whereas other environments (e.g., acute care facilities, extended care facilities, and home care) will have different requirements. Use of hospital invoices to obtain costing data is also a limitation; other considerations should include insurance coverage, contractual pricing, supply chain, and consideration of co-pays and self-pay patients. Finally, the clinical trial data for these products are limited, so the tables should be continuously updated as more data become available.

CONCLUSION

Ideally, future funding for comprehensive, comparative effectiveness studies will provide more concrete answers on which products to choose for specific applications. In the meantime, tools like this can be modified and adapted to accommodate varying circumstances. A further consideration for this interactive tool is to allow for continuous improvement as needs and capabilities change. For example, a mechanism could be developed to regularly update pricing and cost information. A cloud-based platform could allow anyone to plug in their use patterns (*i.e.*, applications per 12 weeks of care) or even modify estimates of 12 weeks of healing to visualize costs relevant to their patients and facility. In conclusion, "Collect Data, Tell Stories" is the mission for our wound research team. Without good data, we have no story; if no story, it is not worth collecting data.

Table 3. Example secondary calculations using biologic products

Product name	Apligraf®	Oasis® wound matrix	Dermagraft®
Cost for duration of care	\$6,816	\$546	\$9,540
Percentage patients healed (venous ulcers)	40% ⁴	55% ⁵	50% ^{b,6}
Cost of 1% patients healed ^a	\$170	\$10	\$191

Cost is based on a review of local hospital invoices done April, 2013.

^aModeled using percentage patients healed for venous leg ulcers.

^bNot approved by the U.S. Food and Drug Administration for this indication. References: Falanga and Sabolinski;⁴ Mostow *et al*;⁵ Omar *et al*.⁶

INNOVATION

This is a simple model, but the authors believe that it provides a valid and useful platform for comparing similar products using information that is available. Although not a true comparative effectiveness study, this is an evidence-based

model that provides useful comparative data to enhance clinical decision-making. The tool reflects real-world usage.

ACKNOWLEDGMENTS AND FUNDING SOURCES

The creation of this comparative tool was accomplished through the efforts of students working on summer research projects.

AUTHOR DISCLOSURE AND GHOSTWRITING

The authors have no relevant conflicts to disclose. The work was not written by any writer other than the authors.

ABOUT THE AUTHORS

Eliot Mostow, MD, MPH is a practicing dermatologist and coleads research efforts in the

Wound Healing and Limb Preservation Center at Akron General Medical Center. He is also professor and chair of the Dermatology Section and chair of the Master Teacher Guild at the Northeast Ohio Medical University, and professor of clinical dermatology at the Case Western Reserve University. Eliot works closely with **Judith Fulton, PhD**, Director of Wound Research at the Akron General Wound Healing and Limb Preservation Center. Judy coordinates bench to bedside research, including basic science, preclinical and clinical trials, as well as education opportunities for residents and students. The wound research team at Akron General also includes **Kimberly N. Blasiolo, RN, MSN, CWOCA**, clinical research nurse coordinator and **Stephannie Miller, BA**, research assistant. Two summer fellowship students participated in this project: **Jon D. Montemayor**, student at the University of Akron and **Sean Pittinger**, student at Boston College.

REFERENCES

1. National Health Service Tayside. Wound Management Formulary. <http://nhstaysideadtc.scot.nhs.uk/wound%20Formulary/Wound%20Formulary%20Front%20page.htm> (accessibility verified July 2, 2013).
2. The Joint Wound Management Formulary Group. Wound Management Formulary. http://formulary.cht.nhs.uk/pdf_doc_files_etc/APC/Wound_Formulary/Wound%20Formulary%203rd%20Edition%20-%202011-13.pdf (accessibility verified July 2, 2013).
3. Newton N: An introduction to wound healing and dressings. *Br J Healthcare Manage* 2003; **19**: 270.
4. Falanga V and Sabolinski M: A bilayered living skin construct (APLIGRAF®) accelerates complete closure of hard-to-heal venous ulcers. *Wound Repair Regen* 1999; **7**: 201.
5. Mostow EN, Haraway GD, Dalsing M, Hodde JP, King D, OASIS Venous Ulcer Study Group: Effectiveness of an extracellular matrix graft (OASIS Wound Matrix) in the treatment of chronic leg ulcers: a randomized clinical trial. *J Vasc Surg* 2005; **41**: 837.
6. Omar AA, Mavor AID, Jones AM, and Homer-Vanniasinkam S: Treatment of venous leg ulcers with Dermagraft®. *Eur J Vasc Endovasc Surg* 2004; **27**: 666.
7. Veves A, Falanga V, Armstrong DG, and Sabolinski ML: Graftskin, a human skin equivalent, is effective in the management of noninfected neuropathic diabetic foot ulcers—a prospective randomized multicenter clinical trial. *Diabetes Care* 2001; **24**: 290.
8. Niezgoda JA, Van Gils CC, Frykberg RG, and Hodde JP: Randomized clinical trial comparing OASIS wound matrix to regranex gel for diabetic ulcers. *Adv Skin Wound Care* 2005; **18**: 258.
9. Marston WA, Hanft J, Norwood P, and Pollak R: The efficacy and safety of Dermagraft in improving the healing of chronic diabetic foot ulcers: results of a prospective randomized trial. *Diabetes Care* 2003; **26**: 1701.