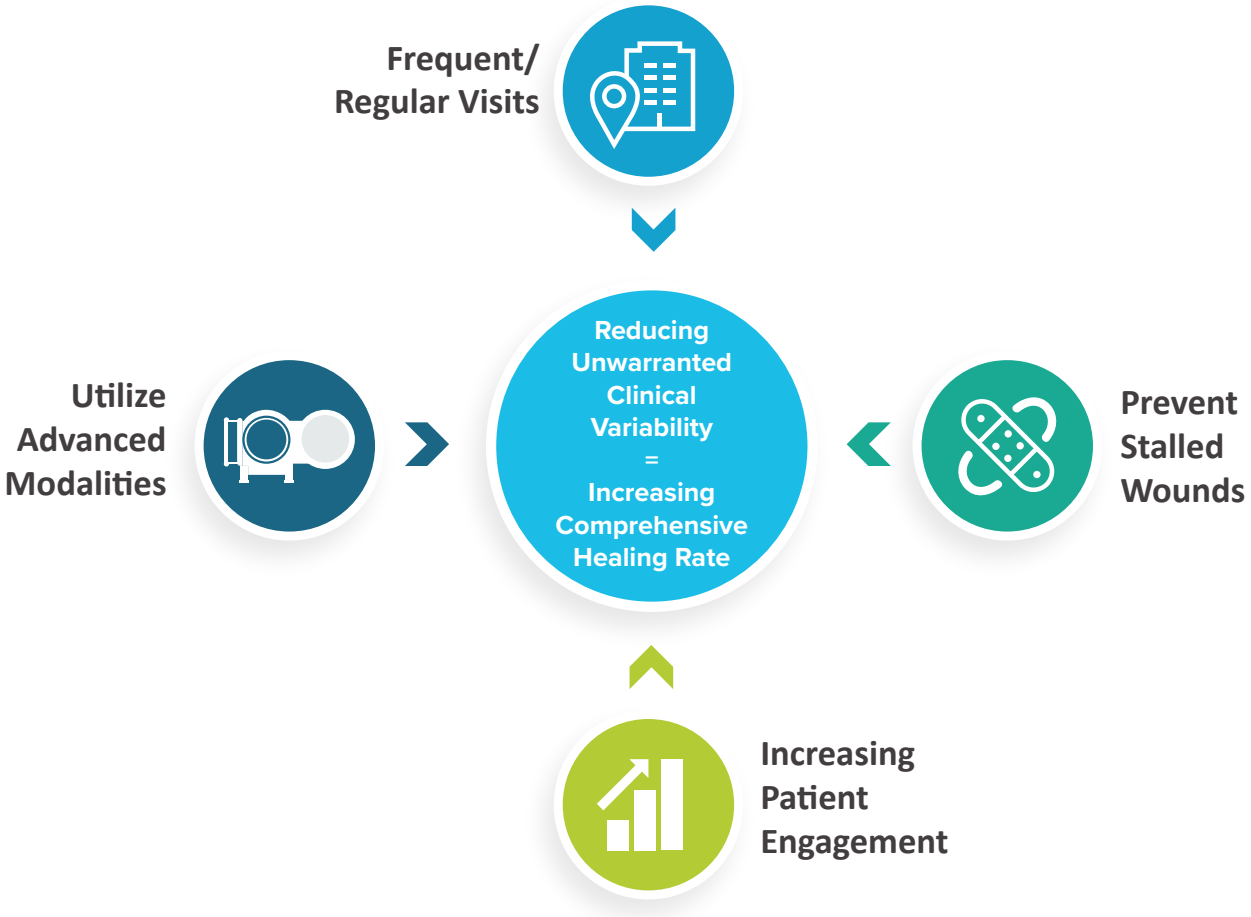
The Impact of Stalled Wounds on Patient Outcomes

William Ennis, DO, Chief Medical Officer

Mary Sheridan, PhD

INTRODUCTION

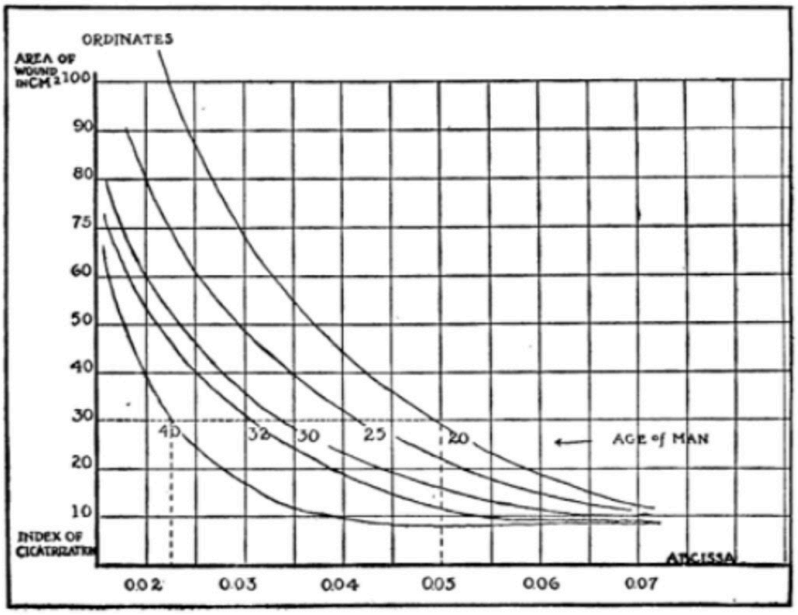
As part of our Patient First focus, Healogics® is dedicated to reducing unwarranted clinical variability across our organization and improving Comprehensive Healing Rates (CHR) amongst our patients. Recently, we introduced four levers that could improve our patient outcomes. These levers included frequent patient visits, the prevention of stalled wounds, improving patient engagement and utilizing advanced modalities. These levers were identified utilizing the "CLEAR" (or Clinically-Led, Evidence-based, Analytically-driven, Research-informed) Approach, which involves reviewing internal and external research to identify evidence-based recommendations. The focus of this paper will be on the evidence and research supporting the key lever of preventing stalled wounds in driving better patient outcomes.



BACKGROUND

Previous research has defined normal and abnormal healing curves for wounds of various etiology. A stalled wound is a wound that is no longer showing normal healing progress, also described as not on its expected healing trajectory. A stalling wound is defined by small reductions in size/area over time when compared to wounds that are on a typical trajectory. This concept in wound care is not a new one. In fact, research on wound healing trajectories (or healing curves) and stalled wounds has been around for more than 100 years. One of the earliest studies was on wound healing in World War I soldiers, which led to the discovery of patterns of standard wound healing.[1] When wound progress stalled compared to their expected healing trajectory, a search for the cause and a modification to the treatment plan was required. In this early research, irrigation, debridement and antibacterial treatments were initiated once stalling was identified. Numerous publications from Dr. Alexis Carrel in the early 1900s described how tracking wounds against their expected wound healing trajectories were predictive of overall healing and how prompt, targeted therapies resulted in returning those wounds back towards their normal healing curves.

Figure 1. Wound healing trajectories by Dr. Carrel published in 1917 to predict the day of healing by patient age.



More recent research has plotted wound healing trajectories and has also consistently found similar patterns of wounds stalling in those that did not heal[2,3,4]. While these studies were conducted in highly controlled clinical trials testing the efficacy of various treatments, in each study, there was a clear pattern of deceleration in wound progress (stalling) in those who do not heal. These stalling patterns in non-healing wounds have been studied extensively across various wound types[5,6], including in venous ulcers[4,7,8], pressure ulcers[2], diabetic foot ulcers[3,4,9] and burn and donor site wounds[10,11]. These studies have a common theme, in which stalling is predictive of whether a wound will ultimately heal or not.

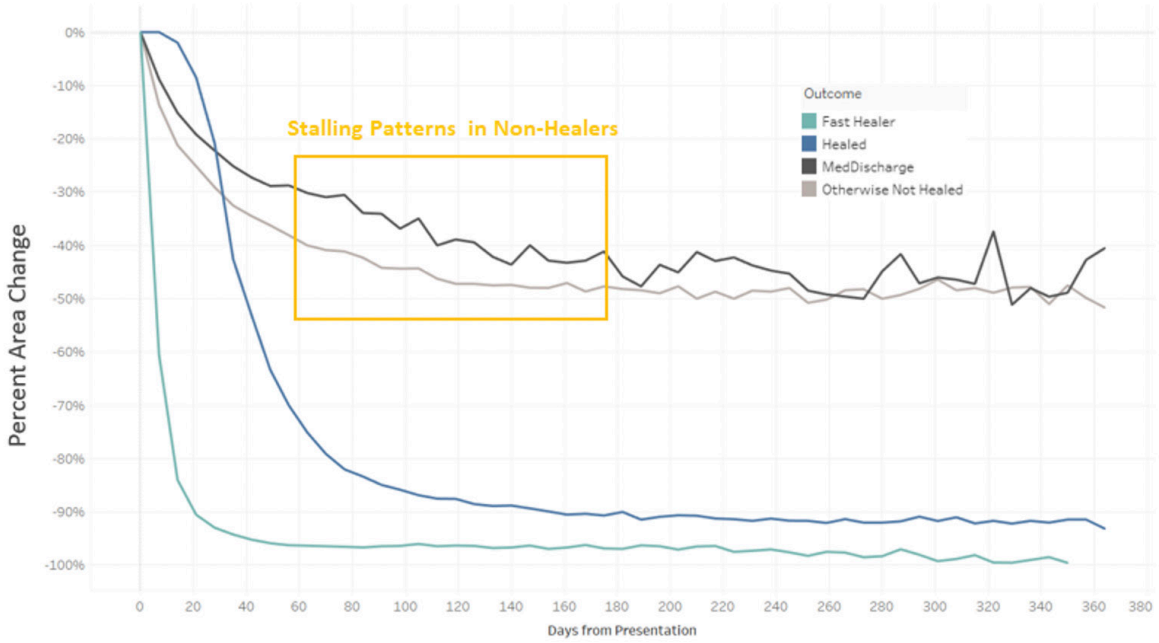
STALLED WOUNDS AND REAL-WORLD EVIDENCE

Based on the extensive research demonstrating that wound stalling is a strong predictor of non-healing, Healogics set out to examine stalled wounds/healing trajectories using our own real-world data. All data presented below is based on wounds discharged in 2019, limited to the outpatient service line and Wound Care Centers® that offer full wound care services. Consults and wounds assessed only once are also

excluded. This data set has consistently been used for all four levers described earlier to ensure statistical inferences have been made from a common data source with high data integrity.

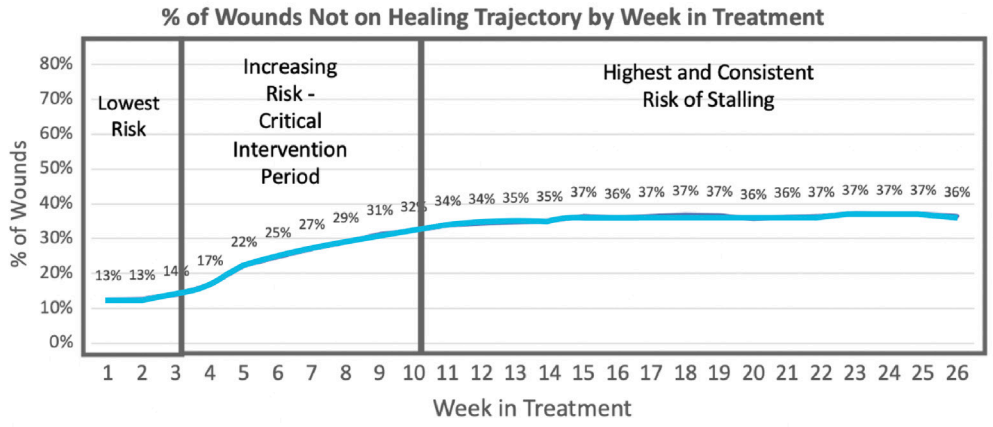
Similar to the previously described research, we found distinct differences in the healing trajectories (based on percent area change) for wounds that healed versus those that did not (Figure 2). Wounds that do not ultimately heal typically demonstrate early healing progress, but then stall out, defined as slow or no additional progress over time. Conversely, wounds that heal typically start with slower progress in the first few weeks then enter a rapid and substantial percent area reduction with each subsequent week. In order to be consistent with the published literature on wound healing in clinical trials, we eliminated fast healers to limit bias and focus on the more complex, advanced wounds typically seen in a wound center. In clinical trials, fast healers are eliminated using the logic that they would heal regardless of the treatment plan, making it difficult to find differences in various treatment plans.

Figure 2. Healogics median percent area change by wound outcome (Fast Healer, Healed, Medically Discharged, Not Healed).



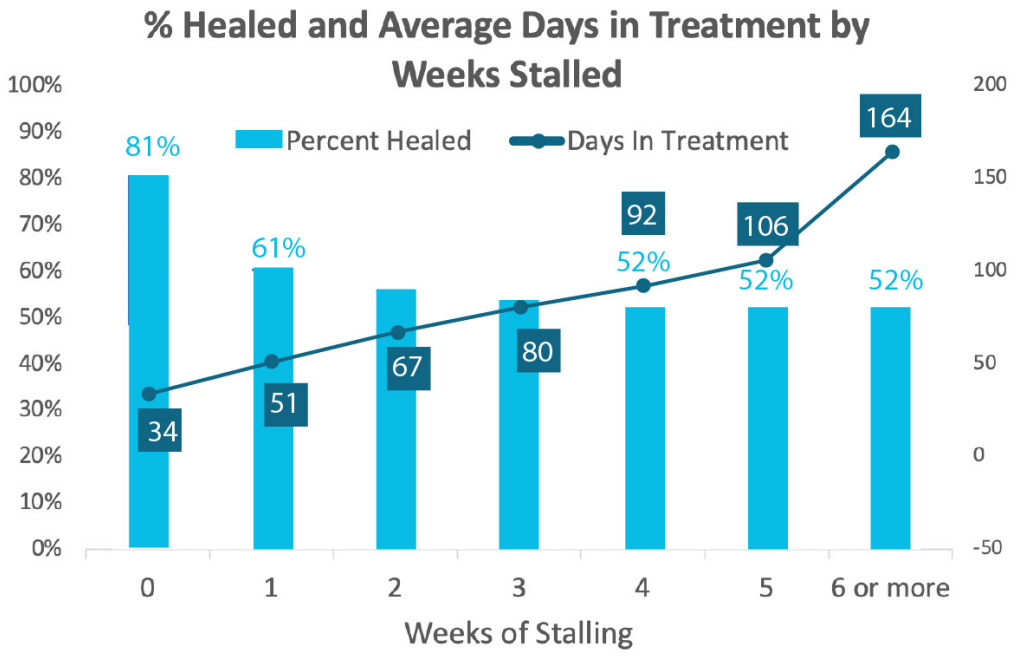
To understand when wounds stall, we looked at the percent area change at each assessment and tracked each wound against the healing trajectory of wounds of similar size at admission. Wounds that fell outside the 75th percentile of expected area reduction at any point were flagged as a stalled wound. Across all wounds discharged in 2019, 27% of wounds stalled at some point during their treatment. Additionally, as demonstrated in Figure 3 below, the percent of wounds identified as stalled increased steadily between Week 4 and Week 10 of treatment. This emphasizes the importance of frequent visits throughout the episode of care, quickly identifying potential issues that can cause a wound to stall, and evaluating the appropriate course of treatment.

Figure 3. Percent of wounds identified as stalled by week in treatment.



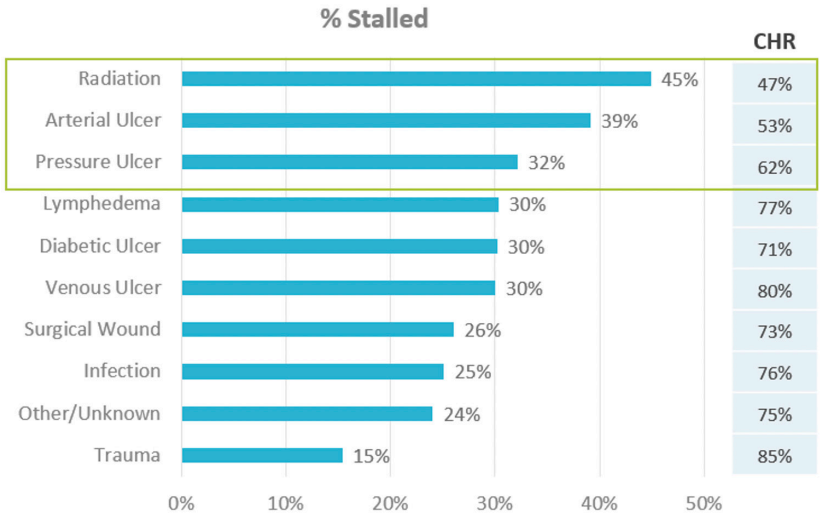
It is important to identify and prevent wounds that are likely to stall because once a wound deviates from its expected healing trajectory, it is less likely to heal and more likely to be in treatment longer than those who never stalled (Figure 4). Additionally, patients who had at least one wound that stalled were 38% more likely to quit treatment than those who have not had a stalled wound. This suggests the momentum of staying on the healing path not only helps accelerate the time to healing, but also may help keep the patient more engaged in their treatment and prevent premature termination of treatment.

Figure 4. Percent of wounds that healed and average days in treatment by the total number of weeks the wound was identified as stalled.



Since stalling impacts likelihood to heal, it is not surprising that the wound types that stall the most are the hardest to heal. As shown in Figure 5, radiation, arterial and pressure ulcers have the highest stalling rates and some of the lowest healing rates. This suggests there is an opportunity to improve care in these harder to heal wounds by regularly monitoring wound progress and adjusting treatment plans by utilizing additional advanced modalities to get more of these wounds back on the path to healing before they stall out completely.

Figure 5. Percent of wounds that stall and Comprehensive Healing Rates (CHR) by wound etiology.



SUMMARY AND CONCLUSION

Healing trajectories and stalling patterns in wound healing are not new concepts and have been studied across various wound types over the past 100 years. It has been well documented that the healing trajectories early in treatment can be predictive of a wounds overall likelihood to heal.

Healogics data reinforces that medical literature and expands upon previous studies by identifying the healing trajectories in real world treatment settings and throughout the healing episode. We found that the risk of stalling increases steadily between Week 4 and Week 10 of treatment, emphasizing the importance of close monitoring of progress during this critical time. Additionally, our data shows that wounds that stall result in suboptimal patient experiences, leading to a lower likelihood to heal, longer time in treatment and higher likelihood in quitting treatment. Finally, we found that some of the hardest to heal wounds, including Radiation, Arterial, and Pressure Ulcers, have the highest stalling rates, suggesting an opportunity for improving care for these wound types.

In order to ensure wounds are on the healing path, ensure patients have weekly visits to allow for the ongoing and accurate measurement of the current healing trajectory. Weekly visits will also allow providers to detect and intervene on wounds that are at risk for stalling earlier. Once a wound's progress appears to slow, it may be necessary to reassess the current plan of care and implement a different strategy including advanced modalities to get them back on the path to healing. Vigilant monitoring and personalizing treatment modalities based on a patient's wound progress can help more wounds to heal and maintain patient engagement throughout the entire episode of care.

A wound's healing trajectory is an important "vital sign" of its progress and needs to be continually assessed to ensure the progress is on track to heal and not beginning to stall. By proactively identifying and intervening on wounds at risk for stalling, we can improve Comprehensive Healing Rates and reduce unwarranted clinical variability across Healogics Centers.

REFERENCES

1 Lewis Freeman, ‘‘Healing Wounded Soldiers to Order,’’ World’s Work 33 (Feb. 1917): 430–39.

2 Payne WG, Bhalla R, Hill DP, Pierpont YN, Robson MC. Wound healing trajectories to determine pressure ulcer treatment efficacy. Eplasty. 2011;11:e1. Published 2011 Jan 10.

3 Robson MC, Hill DP, Woodske ME, Steed DL. Wound healing trajectories as predictors of effectiveness of therapeutic agents. Arch Surg. 2000 Jul;135(7):773-7.

4 Cardinal M, Eisenbud DE, Phillips T, Harding K. Early healing rates and wound area measurements are reliable predictors of later complete wound closure. Wound Repair Regen. 2008 Jan-Feb;16(1):19-22.

5 Zhou K, Schenk R, Brogan MS. The wound healing trajectory and predictors with combined electric stimulation and conventional care: one outpatient wound care clinic's experience. Eur J Clin Invest. 2016 Dec;46(12):1017-1023.

6 Ennis WJ, Meneses P. Wound healing at the local level: the stunned wound. Ostomy Wound Manage. 2000 Jan;46(1A Suppl):39S-48S

7 Norris R, Chapmanjones D. Healing trajectories as an indicator of clinical outcomes in patients with venous leg ulcers. Wounds UK. 2015;11(4): 68-73.

8 Hill DP, Poore S, Wilson J, Robson MC, Cherry GW. Initial healing rates of venous ulcers: are they useful as predictors of healing? Am J Surg. 2004 Jul;188(1A Suppl):22-5.

9 Sheehan P, Jones P, Caselli A, Giurini JM, Veves A. Percent change in wound area of diabetic foot ulcers over a 4-week period is a robust predictor of complete healing in a 12-week prospective trial. Diabetes Care. 2003 Jun;26(6):1879-82.

10 Rittenhouse BA, Rizzo JA, Shields BA, Rowan MP, Aden JK, Salinas J, Fenrich CA, Shingleton SK, Serio-Melvin M, Burmeister DM, Cancio LC. Predicting wound healing rates and survival with the use of automated serial evaluations of burn wounds. Burns. 2019 Feb;45(1):48-53.

11 Nitzschke SL, Aden JK, Serio-Melvin ML, Shingleton SK, Chung KK, Waters JA, King BT, Burns CJ, Lundy JB, Salinas J, Wolf SE, Cancio LC. Wound healing trajectories in burn patients and their impact on mortality. J Burn Care Res. 2014 Nov-Dec;35(6):474-9.