

students to LMIC to transfer skills and learning and to encourage emerging researchers in HIC to engage in global health. HIC also should ensure that all grant applications include mentorship and teaching tasks to ensure that LMIC capacity is built. Last, they should be encouraged to publish findings in Open Access journals (or pay for open access) to ensure that findings are accessible.

We believe that these principles should serve as a point of reference to ensure mutually beneficial and successful partnerships. Investment of time and resources in such partnerships may not only ensure that research is delivered successfully but also may move the state of science toward closing the gaps in palliative care equity experienced in LMIC.<sup>10</sup> Robust evidence is essential to achieving this and is required by the World Health Assembly's Resolution on Palliative Care (2014). We also believe that lessons from sub-Saharan African partnerships with HIC also may serve to assist those developing research in other LMIC and to expand the scope and understanding of palliative care research in HIC.

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## *The Numbers Don't Speak for Themselves: Biochemical Values Associated With Pressure Ulcer Healing in Patients With Advanced Illness*



To the Editor:

Patients in the palliative care setting are the cohort within health care that exhibit the highest incidence and prevalence of wounds, with pressure ulcers being the most prevalent wound class.<sup>1</sup> These wounds are a source of significant morbidity and have been shown to be associated with decreased survival in patients with advanced cancer and noncancer illness.<sup>2,3</sup> Furthermore, establishing goals of wound management is frequently more challenging in this population, as multiple factors contribute to a shift away from complete healing in the wound management paradigm.<sup>4</sup> Thus, a better understanding of the parameters associated with healing can facilitate better goal setting for wound management and allow for more effective treatment plans.<sup>4</sup>

In an effort to address this challenge, a recent article published by Maida et al. in this journal

Table 1  
**Biochemical Parameters Associated With Complete Healing of Stage-II Pressure Ulcers<sup>a</sup>**

Laboratory Value	Mean in Completely Healed	Mean in Not Completely Healed	P-Value
Hemoglobin	104.9 ± 5.010, n = 19	111.3 ± 1.457, n = 136	0.2338
White blood cells	10.54 ± 1.095, n = 19	13.10 ± 1.021, n = 136	0.0932
Platelets	299.8 ± 23.74, n = 19	287.4 ± 10.22, n = 136	0.6352
Albumin	22.96 ± 1.213, n = 19	23.15 ± 0.5038, n = 131	0.8833
Erythrocyte sedimentation rate	64.03 ± 9.340, n = 18	70.68 ± 3.559, n = 106	0.5124
C-reactive protein	100.8 ± 18.88, n = 18	88.08 ± 7.051, n = 98	0.5343
Creatinine	76.53 ± 6.820, n = 19	133.8 ± 7.507, n = 135	<0.0001

<sup>a</sup>Mean values calculated using available biochemical and hematologic values from the sample group (N = 147) with Stage-II pressure ulcers. Laboratory values were not available for all patients.

examined the association between various clinical parameters and the complete healing of Stage-II pressure ulcers in a patient population with advanced illness.<sup>4</sup> Looking at 147 patients with a total 245 Stage-II pressure ulcers, it was found that 23 (9.4%) healed completely.<sup>4</sup> Univariable and multivariable analysis demonstrated that higher Palliative Performance Scale (PPS) scores were the only clinical parameter associated with complete healing of Stage-II pressure ulcers.<sup>4</sup> The PPS incorporates five parameters, including ambulation, activity, evidence of disease, self-care, intake and level of consciousness, to assess performance status.<sup>5</sup> As a proven tool for prognostication, monitoring deterioration, and guiding treatment, the PPS has been widely adopted in the palliative care community.<sup>5</sup> Using clinical parameters that are easily attainable at the bedside, Maida et al. point out that the PPS can be a key prognostic tool for not only “quoad vitam” (prediction of life expectancy) but also “quoad sanationem” (prediction of healing capacity).<sup>4</sup> Furthermore, since the publication of Maida et al.’s original article, a conversion chart has been developed for translating Clinical Frailty Scale scores, a measure of frailty used widely by geriatricians, to PPS scores.<sup>5</sup> This tool, developed by Grossman et al., has the potential to broaden the scope of clinical parameters available for wound prognostication while encouraging other specialties to incorporate wounds into their prognostic models.<sup>5</sup>

However, in an attempt to build on Maida et al.’s initial findings and determine other parameters associated with wound healing in patients with advanced illness, subsequent analysis of an updated version of the original data set was carried out. In this analysis, we examined the association between common biochemical and hematologic laboratory values available for the patients who had Stage-II pressure ulcers that healed completely. As in the initial investigation, complete wound healing was defined as complete wound closure coupled with restoration of complete epithelialization over a former wound site.<sup>4</sup> The laboratory values assessed included hemoglobin, white blood cells, platelets, lymphocytes, erythrocyte sedimentation rate, C-reactive protein, albumin, and

creatinine. A Welch’s unpaired t-test was used to compare the mean for each of these values between patients that experienced complete wound healing and those whose wounds remained unhealed. The data are presented in Table 1.

Of all the values, only creatinine was shown to demonstrate a statistically significant difference between the healing (76.5 µmol/L ± 6.82, n = 19) and nonhealing groups (133.8 µmol/L ± 7.51, n = 135) (P < 0.0001). As expected, the mean creatinine level was greater in the nonhealing group and was outside the normal range for both females and males (females: 50–90 µmol/L; male: 70–120 µmol/L), as renal impairment is known to affect wound healing.<sup>6</sup> Many common risk factors associated with poor wound healing in patients with chronic kidney disease or end-stage renal disease are also observed in our patient population. Poorly controlled diabetes, peripheral neuropathy and vascular disease, venous insufficiency, uremia, and calciphylaxis can all contribute to poor wound healing in the patient with advanced illness, who suffers from kidney dysfunction.<sup>6</sup> It should be noted that the authors are aware that creatinine levels are only a rough proxy for kidney function and future investigations should examine the glomerular filtration rate. The differences between the means of all other laboratory values examined were of no statistical significance.

Realistic goal setting and treatment programming for wound management requires an understanding of healing potential. Thus, the association between lower creatinine, a commonly obtained laboratory value, and wound healing may provide the clinician with yet another parameter to assist with “quoad sanationem” (prediction of healing capacity). However, these findings are not to be used in isolation. When coupled with the original findings of Maida et al., this association actually highlights the fact that wounds are a reflection of a patient’s global health status and that the factors contributing to wound healing are multifactorial. Clinicians must appreciate that appropriate wound management requires a systemic, “whole-person” approach, which ultimately involves understanding and synthesizing the clinical, biochemical, and other factors that all contribute to the wound-healing process.

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