

# Disparities in wound care: Part 1 physiologic, social, and environmental etiologic mechanisms for disparate wound outcomes

Final report of the Diversity, Equity, and Inclusion for Wound Care (DEIWC) Task Force of the Association for the Advancement of Wound Care with critical review by the European Wound Management Association

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## ABSTRACT

Significant progress has been made in the treatment of wounds, including knowledge of evidence-based wound bed preparation and use of advanced therapies to enhance healing. Yet access to these improved outcomes is not equitably distributed across populations.<sup>1</sup> In early 2022, to tackle this issue, the Board of Directors of the Association for the Advancement of Wound Care (AAWC) created the multidisciplinary Diversity, Equity and Inclusion in Wound Care (DEIWC) task force. The DEIWC task force was charged to address three aims: 1) examine the complex issue of disparities in wound care and provide unified recommendations for wound care clinicians, 2) identify technological approaches and best practices for skin and wound assessment, and 3) investigate disparities in pressure injuries. Three approaches were used by the DEIWC task force: comprehensive literature review (Aim 1 and 2); systematic review (Aim 3); critical review with consensus by experts (all aims). This is the final report of the task force for Aim 1. The purpose of this report is to provide an overview on the etiologic mechanisms of disparities that exist in wound care that impact the complex wounds that clinicians treat and actions for wound care clinicians that may decrease disparities and improve inclusivity in wound care.

**Keywords** diversity equity and inclusion, health disparities, wounds, wound care, wound management

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## KEY MESSAGES

- In an ideal clinical setting where every patient is receiving the best evidence-based health care disparate outcomes would still occur because 80% of health outcomes are not due to care that is provided but instead related to the environment and social conditions patients live within.
- There are physiologic, social, and environmental etiologic mechanisms for disparate health outcomes.
- By examining and acknowledging current gaps in wound care, there are opportunities to improve outcomes across populations by delivering more equitable care.
- Everyone has a role to play in increasing health equity be it researchers including culturally competent demographic data, clinicians acknowledging bias and access issues, or policy makers designing appropriate pathways for the inclusive provision of healthcare.

Significant progress has been made in the treatment of wounds including knowledge of evidence-based wound bed preparation and use of advanced therapies to enhance healing. Yet access to these improved outcomes is not equitably distributed across populations.<sup>1</sup> In early 2022 to

tackle this issue the Board of Directors of the Association for the Advancement of Wound Care (AAWC) created the multidisciplinary Diversity, Equity and Inclusion in Wound Care (DEIWC) task force. The DEIWC task force was charged to address three aims: 1) examine the complex issue of disparities in wound care and provide unified recommendations for wound care clinicians, 2) identify technological approaches and best practices for skin and wound assessment, and 3) investigate disparities in pressure injuries. The DEIWC task force met virtually biweekly throughout 2022 with smaller groups conducting additional meetings to accomplish the charge. Three approaches were used by the DEIWC task force: comprehensive literature review (Aim 1 and 2); systematic review (Aim 3); critical review with consensus by experts (all aims). This is the final report of the task force for Aim 1. Two members of the European Wound Management Association (EWMA) board of directors who were appointed by the board as EWMA representatives participated with the AAWC DEIWC task force by reviewing this manuscript and providing suggestions for additional content and revisions during final manuscript preparations.

The purpose of this report is to provide an overview on the etiologic mechanisms of disparities that exist in wound care that impact the complex wounds clinicians treat and actions for wound care clinicians that may decrease disparities and improve inclusivity in wound care.

There are physiologic, social, and environmental etiologic mechanisms for disparate health outcomes. These health disparities are preventable differences in the burden of disease and opportunities experienced by disadvantaged populations.<sup>2</sup> Disparities in social determinants of health, bias, chronic exposure to stress, and generational traumas lead to clinically relevant alterations in wound occurrence and wound healing.<sup>1</sup> Table 1 provides the task force recommended actions for clinicians related to physiologic, social, and environmental etiologic mechanisms for disparate wound outcomes.

Health equity acknowledges that everyone does not start from the same place or require the same interventions. In an ideal clinical setting where every patient is receiving the best evidence-based health care disparate outcomes would still occur. This is because 80 percent of health outcomes are not due to the care that is provided.<sup>3,4</sup> Instead, these outcomes are related to the environment and social conditions

patients live within. These are collectively known as social determinants of health (sDOH). The environment influences health outcomes. This includes local, environmental, and social variables (such as pollution, noise, toxins, microbes, experience of stress, uncertainty, social isolation, social injustice). These environments lead to neuro-hormonal responses that affect gene transcription and regulation. Altered health behaviors that lead to toxic cellular micro-environments also influence molecular and cellular behavior and create the potential for negative wound healing outcomes.

## THE PHYSIOLOGIC BASIS FOR DISPARATE AND DELAYED HEALING

Negative health outcomes associated with chronic exposure to stress are due to the adoption of health risk taking behaviors as well as the physiologic response to stress.<sup>5,6</sup> During the stress response the glucocorticoids including cortisol is released.<sup>1-4,8</sup> Short term exposure to cortisol can be beneficial, acting as an anti-inflammatory agent and mobilising glucose to use during a stress response.<sup>1</sup> Chronic exposure to cortisol becomes pro-inflammatory and is associated with tissue degradation leading to cellular death.<sup>1,9</sup>

Table 1. Recommended actions for clinicians related to physiologic, social, and environmental etiologic mechanisms for disparate wound outcomes

Mechanisms for disparate wound outcomes	Recommended clinician actions
Physiologic	Include a depression screen, such as the Patient Healthcare Questionnaire 2 and 9 (PHQ-2, PHQ-9), as part of standard patient history
	Include a resilience scale as part of the standard patient history
	Include resources for resilience interventions as part of standard patient education materials, such as mindfulness training, cognitive-behavioral therapy, coaching, stress management, building support networks and connecting with others, psychoeducation (building knowledge), physical activity, and alternative therapies (such as pet or music therapy)
Social and environmental	Advocate for improving access to health and wound care
	Use of telehealth for wound care
	Knowledge of low-cost wound resources in the community
Delivery of care: implicit bias	Take an implicit bias association test
	Take an implicit bias course
	Use a standardised diagnostic interviewing approach and assessment for every patient
	Consider using a checklist to be sure equity is provided in wound assessment and management
Lack of representation in research: for clinicians	Consider the value of real-world data (such as patient registries, electronic health records)
	Consider the value of pragmatic clinical trials in wound research
	Be cognisant of the race/ethnicity of the research sample and how the sample diversity relates to the clinician's patients
Lack of representation in research: for researchers	Trial outcomes reporting should be decided with input from patient representatives and should reflect the latest recommendations on patient reported outcome measures (PROMs)
	Involve a patient who has/had a wound on the project team or if feasible, consider a community partnership, involving community leaders in the project team and as part of the project
	Use existing and validated Core Outcome Sets
	Collect demographic variables including skin tone, gender, cultural, SES, and religiously sensitive variables
Access to care	Be aware of patient assistance networks and community resources and other sites of care where patients can access needed services
	Participate in political advocacy to support patient access to care
	Join a professional organisation to gain awareness of advocacy initiatives and provide avenues for advocating for patients
	Maintain a commitment to lifelong learning to establish an evidence-based standard of care

This contributes to an expedited aging process and can increase the experience of pain.<sup>10</sup> Glucocorticoid release, such as that occurring with chronic exposure to stress contributes to delayed healing.<sup>1</sup> Blocking glucocorticoid function with a glucocorticoid receptor antagonist removes stress-induced delayed wound healing seen in animals.<sup>11</sup> When examining lifetime stressors (adverse childhood events, generational trauma, poverty) the epigenetic changes and biochemical responses lead to delayed wound healing through several mechanisms including telomere shortening and histone modifications.<sup>6,7,12-14</sup> Even routine or short-term stress has been associated with delayed wound healing; For example, higher reported stress levels on the day of an excisional skin biopsy have been associated with delayed healing of the biopsy sites.<sup>15</sup> The association between stress and wound repair is not only statistically significant, but also clinically relevant.<sup>1</sup>

Psychological stress impacts healing through biological and behavioral factors.<sup>19</sup> Due to the biochemical stress response complex wounds experience hypoxia, decreased cytokines, and alterations in matrix metalloproteinases.<sup>15</sup> Other potential biological etiologies of delayed wound healing related to psychological stress are from alterations in immune response; increased rates of infection have been observed during periods of stress potentially due to decreased neutrophil infiltration and decreased levels of antimicrobial peptides.<sup>15</sup> The physiologic response to stress also alters the human microbiome.<sup>16,17</sup> High levels of oxidative stress, which occurs in many chronic wounds, decreases the diversity of wound microbiota, and promotes the formation and maturation of biofilm<sup>16</sup> which is associated with delayed wound healing.

After a stressful event people can continue to suffer negative effects. Stress and neglect can be experienced so deeply that they are associated with biochemical changes to DNA; these are known as epigenetic changes.<sup>17-20</sup> Epigenetics is the study of changes in organisms caused by modification of gene expression rather than alteration of the genetic code itself. Epigenetic changes can be heritable, meaning they are passed down through generations.<sup>17-19</sup> The stress associated with adversity is associated with epigenetic changes including DNA hypo- and hyper- methylation, histone modifications, and telomere shortening.<sup>7,20</sup> Because epigenetic changes are heritable, associated with stress, and contribute to the development of human disease they are a physiologic explanation for historical trauma, sometimes known as intergenerational trauma.<sup>21,22</sup> Historical trauma is experienced by a specific cultural group that has a history of being systematically oppressed.<sup>21,22</sup> In addition to the ongoing social and cultural difficulties experienced by these populations, epigenetic changes may represent a lingering nidus of increased chronic disease risk that perpetuates disparities in outcomes for these populations, such as the acquisition of conditions associated with developing wounds and those conditions which delay wound healing.

The biophysical response to stress leads to both the development of conditions associated with wounds and delayed wound healing. Many persons with wounds have concomitant chronic diseases including venous disease, peripheral arterial disease, and diabetes. Life-long treatment and self-care is essential for managing chronic disease and when a wound is present the person's own efforts are especially important.<sup>23,24</sup> Yet continuous self-

care is demanding, and patients can experience repetitive psychological stress, lowered self-esteem, and social isolation in addition to the physical symptoms.<sup>1,24</sup> This can leave patients with wounds vulnerable to maladaptation and depression which is a positive feedback loop due to their association with delayed wound healing.<sup>1,25-27</sup>

## RECOMMENDED ACTIONS FOR CLINICIANS

Recommended actions for wound care clinicians include use of additional assessment tools to screen for depression and resiliency and resiliency education and resource materials for patients. Including a depression screen such as the Patient Healthcare Questionnaire 2 and 9 (PHQ-2, PHQ-9), as part of standard patient history provides the opportunity for treatment (Table 1). (The tool is available at [https://med.stanford.edu/fastlab/research/imapp/msrs/\\_jcr\\_content/main/accordion/accordion\\_content3/download\\_256324296/file.res/PHQ9%20id%20date%2008.03.pdf](https://med.stanford.edu/fastlab/research/imapp/msrs/_jcr_content/main/accordion/accordion_content3/download_256324296/file.res/PHQ9%20id%20date%2008.03.pdf)).

Resilience is the individual's ability to cope with experienced stress. Resilience has more than positive psycho-social effects. How humans perceive stress influences the physiologic response to it. The ability to positively perceive stressors limits the negative health outcomes associated with chronic stress.<sup>10</sup> Thus, interventions that support resilience of people with wounds can increase positive adaptation and improve outcomes.<sup>28</sup> To better recognise people for whom resilience strengthening interventions may be helpful, consider using a resilience scale as part of the standard patient history. Several tools for measuring resilience exist. The Brief Resilience Scale contains six items that measure the ability to 'bounce back' after stressful events.<sup>29</sup> The Connor-Davidson Resilience Scale (CD-RISC)<sup>30</sup> contains 25 items, all of which carry a 5-point range of responses, as follows: not true at all (0); rarely true (1); sometimes true (2); often true (3); and true nearly all the time (4). The scale is rated based on how the subject has felt over the past month. These tools provide an objective measure of a patient's resilience and can assist the wound care clinician in determining which patients may benefit from resilience training.

Wound care clinicians can include resources for resilience interventions as part of standard patient education materials. Evidence-based interventions that promote resilience include mindfulness training, cognitive-behavioral therapy, coaching, stress management, building support networks and connecting with others, psychoeducation (building knowledge), physical activity, and alternative therapy (such as pet or music therapy).<sup>28</sup> Many resilience-strengthening interventions also reduce anxiety and depression.<sup>10,28</sup>

At a policy level, wound care clinicians can advocate for safe housing, food, and supportive communities as these structural drivers of health impact patients' cumulative stress, including the biophysical stress response and its associated impact on health outcomes.

## SOCIAL AND ENVIRONMENTAL BASIS FOR DISPARATE OUTCOMES

Social isolation impacts over 200 genes<sup>31</sup> including the down regulation of antiviral response and production of antibodies, and up regulation of the inflammation cascade. Social isolation is also a known correlation in delayed wound healing.<sup>32</sup> The

deleterious effects of stress on wound healing have been found to be associated with social isolation and ameliorated through positive social interaction.<sup>11</sup> For example, increased wound clinic visit frequency is associated with better healing outcomes.<sup>33,34</sup> Although there are multiple potential etiologies of augmented wound healing when patients are seen in a wound clinic more frequently, it is reasonable that a sense of belonging and social interaction produces positive biochemical responses, supporting wound healing.

Trauma-related events often have occurred in the context of service provision creating the potential for mistrust in majority groups and government-funded services. This has also occurred in the context of research, as well as in health and mental health care. For members of communities impacted by these historical traumas, daily reminders of discrimination can exacerbate individual responses to trauma.<sup>35</sup> Increased provider awareness and respect of these traumas can build trust.

In addition to the stress associated with environments, the environment can also prohibit or promote access to specialised healthcare services. Barriers to health services include the high cost of care, inadequate insurance coverage, unavailability of services in a community and lack of culturally-competent care.<sup>36,37</sup>

## RECOMMENDED ACTIONS FOR CLINICIANS

Recommended actions for wound care clinicians include improving access to health and wound care, use of telehealth and knowledge of low-cost wound resources. To increase access to healthcare and attempt to limit the downstream health impact of homelessness some health care providers, especially medical and nursing students, have developed street medicine programs. Street medicine is a term that defines the provision of health care to unsheltered homeless directly where they live. This includes walking teams and ad hoc mobile clinics to directly access and provide care in areas with rough sleeping conditions (tent encampments, overpasses, etc).<sup>38,39</sup> Use of telehealth is especially useful for wound care. Delivering wound care via telehealth can increase access to specialty care.<sup>40</sup> Wound care clinicians should be aware of community resources such as free or low-cost ambulatory care clinics, street medicine programs, health fairs that provide free screening, and low-cost alternatives for care (for example, most pharmacies have a discounted generic medicine and wound dressings list).

## DELIVERY OF CARE DISPARITIES

In addition to overt bias which people may choose to mask for the purposes of social or political correctness, implicit bias is a source of health care disparities.<sup>41</sup> Implicit social cognition refers to the unconscious, involuntary attitudes or stereotypes that affect our actions; these involuntary biases can impact clinical decision making and treatment of patients in healthcare settings. Healthcare providers exhibit the same levels of implicit bias as the wider population.<sup>41</sup> When implicit bias is measured and studied it has been associated with a lower quality of care.<sup>41</sup>

## RECOMMENDED ACTIONS FOR CLINICIANS

Take an implicit bias association test <sup>42</sup> (available at <https://implicit.harvard.edu/implicit/>). There are a variety of

implicit bias association tests that anyone can take to better understand their own implicit biases. Take an implicit bias course, for example, the one at <https://equity.ucla.edu/know/implicit-bias/>. This site has a 30-minute video series that explains implicit bias and approaches to counter implicit bias. The site contains multiple other resources and evidence of implicit bias across various areas.<sup>43</sup> There is some evidence that a person's knowledge and recognition of their implicit biases is an effective method of countering implicit bias.

Use of a standardised diagnostic interviewing approach and assessment for every patient can help decrease implicit bias in wound care. Ask the same questions, order the same laboratory and diagnostic tests, provide the same options for treatment, and offer the same resources to all patients with the same wound etiology and diagnosis. Consider using a checklist to be sure equity is provided in wound assessment and management.

## LACK OF REPRESENTATION IN RESEARCH

Current wound research does not commonly include the diverse wound etiologies and patient presentations that occur in clinical practice and wound centers, typically excluding diagnoses outside of venous leg ulcers, pressure injuries, and diabetic foot ulcers. Exclusion criteria frequently exclude real world patient variables common to clinical practice and wound centers including exposed structures, peripheral vascular disease, elevated hemoglobin A1C, autoimmune disorders, non-adherence to care plans, large and small wounds,<sup>44</sup> and poor nutrition. The exclusion of these patient types artificially inflates heal rates as only the easiest wounds to heal are being studied; wound heal rates as high as 95% have been reported<sup>44,45</sup> when data from research with more inclusive criteria demonstrate heal rates closer to 30–45%.<sup>46,47</sup> Approval and indications for new therapeutics are generally restricted to the demographics of the population in clinical studies.<sup>48</sup> This ultimately negatively influences coverage of advanced therapies for patients as many insurance providers have limited use of advanced therapies for patients that would medically benefit from them. In addition, the widespread use of invalidated outcome measures and lack of consensus-derived definitions supports the need for standards for measuring outcomes with acceptable inter-rater reliability and validated measures of patient-reported outcomes to provide more meaningful evaluations of wound management.<sup>49</sup>

Distrust in governmental and majority groups including the clinical research enterprise and medical establishment contributes to disparate representation in research.<sup>50–54</sup> These barriers to participation in clinical studies among some populations increases the lack of diversity by race and ethnicity and the lack of reporting of these demographic characteristics in clinical research.<sup>48</sup> This is compounded by the lack of race/ethnicity reporting in clinical trials, with only 43% of US-based clinical trials (registered in ClinicalTrials.gov from March 2000 to March 2020) reporting any race/ethnicity data.<sup>55</sup> Interestingly, clinical trials funded by industry were negatively associated with race/ethnicity reporting and enrolment. This has implications for wound research, as many clinical trials related to wound care are industry-funded. A global systematic review profiling venous leg ulcer research highlighted the lack of both reporting and inclusion of race and diversity in study populations.<sup>25</sup> Race and ethnicity are

considered social constructs that do not have biological meaning; however, it is still recommended to report race and ethnicity in research to include the potential associated impact of social stratification, injustices, inequities, and implications for population health.<sup>56</sup>

## RECOMMENDED ACTIONS FOR CLINICIANS

Wound care clinicians should consider the value of real-world data (such as patient registries, electronic health records) and pragmatic clinical trials in wound research as this trial design offer advantages at the level of eligibility criteria, level of control and standardisation, sample size calculation, and may better reflect clinical practice for wound care clinicians. When reviewing wound care research clinicians should be cognisant of the race/ethnicity of the research sample and how the sample diversity relates to the clinician's patients.

For those conducting wound care research, trial outcomes reporting should be decided with input from patient representatives and should reflect the latest recommendations on patient reported outcome measures. Wound care researchers should consider involving a patient who has/had a wound on the project team or if feasible, consider a community partnership, involving community leaders in the project team and as part of the project. Existing and validated core outcome sets should be used in trial design and demographic variables should be collected including skin tone, gender, cultural, socioeconomic status, and religiously sensitive variables.

## ACCESS TO CARE DISPARITIES

A key frustration experienced by wound care clinicians and health care professionals in nations without universal healthcare (such as the United States) is that of being forced to deliver disparate care due to insurance coverage. Instead of recommending treatments based on outcomes and evidence clinicians are forced to consider insurance coverage and financial ability instead of patient need. This is due to not only the number of un-insured patients, but also the increasing number of under-insured patients. Under-insured patients have health insurance coverage but are not able to afford care or treatment. This can be due to a constellation of issues including large out of pocket maximums and co-pays, denial of advanced therapies by their insurance companies, and other complex social conditions. Patients may be able to prioritise and afford health insurance coverage but are then unable to pay out of pocket for necessary components such as transportation, nutrition, or wound supplies. This vulnerable population delays or avoids health care because of costs at twice the rate of people who are insured but not underinsured. Insurance-based practice, as opposed to evidence-based practice occurs when patients would benefit from a medically-necessary wound therapy, but insurance has limited its use.

Access to wound care for vulnerable populations is not equitable.<sup>57</sup> Disparities in social determinants of health contribute to up to a 30-year reduction in life expectancy for people experiencing homelessness; this is due to issues including overdose, nutritional deficiencies, alcohol and tobacco abuse, mental health disorders, poor self-management of chronic disease, and infectious disease.<sup>39</sup> Even among wound clinicians, a lack of consistent guidelines

leads to massive differentiation in standard of care delivered to patients.<sup>3,45,58</sup> Disparities in accessing wound dressing types, cleansers, advanced therapies, specialty referral, and skilled treatment leads to variability in healing outcomes.<sup>58,59</sup>

## RECOMMENDED ACTIONS FOR CLINICIANS

Wound care clinicians should be aware of patient assistance networks and community resources and other sites of care where patients can access needed services. Examples of patient assistance networks include: the Triumph Foundation for educating people who are newly disabled (<https://triumph-foundation.org/resource/skinhealth/>); the National Pressure Injury Advisory Panel Patient Advisory Council (<https://npiap.com/page/PAC>); and Muscular Dystrophy UK's *Getting support for pressure ulcers* (<https://www.muscular dystrophyuk.org/support/information/your-condition/pressure-ulcers/>). Wound care clinicians can participate in political advocacy to support patient access to care. Joining a professional organisation can provide awareness of advocacy initiatives and provide avenues for advocating for patients. Maintaining a commitment to lifelong learning to establish an evidence-based standard of care allows wound care clinicians to remain current in their wound care practice.

## CONCLUSIONS

By examining and acknowledging current gaps in wound care, we discover additional opportunities to improve outcomes across populations by delivering more equitable care. Our molecular, cellular, social, and physical environments are bi-directional connections to the development of conditions associated with wounds and successful healing outcomes.<sup>1</sup> Disparities in pressure injury incidence and healing were noted in literature dating back to the late 1900s; however, it was not until recently that the healthcare community at large has acknowledged the need for multi-faceted intervention. Everyone has a role to play in increasing health equity be it researchers including culturally competent demographic data, clinicians and instructors including best practices across skin tones in skin and wound assessments, or policy makers designing appropriate pathways for the inclusive provision of healthcare. At the systems level, interventions are needed that aim to reduce the drivers of disparities. Creating a culture of health that prevents illness requires access to structural drivers of health such as safe staffing levels, housing, food, education, and healthcare, including mental healthcare.<sup>3</sup>

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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