

# Skin tone bias and wound care: highlighting the current evidence and addressing the gaps in knowledge of dark skin tones

## KEY WORDS

- ▶▶ Health bias
- ▶▶ Health delivery
- ▶▶ Literature review
- ▶▶ Skin tones
- ▶▶ Wound care

Disparities and biases in healthcare delivery due to ethnicity have been highlighted. A PubMed literature search was conducted in December 2021 to identify the current evidence and gaps in skin tone bias and wound care. A total of 23 articles published between 2016 and 2021 were identified on skin tones and wound care using a range of related search terms. The lack of findings in the literature, plus the guidance in the Wounds UK Best Practice Statement (Dhoonmoon et al, 2021), highlighted the need for more research around wound care and skin tones. In wound care education, there is a need for use of case studies and photographs of dark skin tones to aid knowledge across the full range of skin tones, and to address the gap in bias around light skin tones (Dhoonmoon et al, 2021). Additionally, the only relevant papers about specific wound types focused on pressure ulcers. Therefore, more evidence is needed around other common wounds to aid education and practice.

Discrepancies in healthcare have long been an issue, with evidence-based best practice guidance needed to ensure that patients receive the best possible care. Disparities and biases due to ethnicity have been highlighted in particular. For example, Black women are four times more likely than white women to die in pregnancy or childbirth, with women from Asian ethnic backgrounds facing a two-fold risk (MBRRACE-UK, 2020).

It is evident that urgent action is needed to tackle systemic biases contributing to unequal outcomes across healthcare (Limb, 2021). In wound care, optimising treatment and outcomes for the individual patient depends on accurate assessment and diagnosis, for which knowledge of the signs and symptoms across skin tones is essential (Mukwende, 2020).

There is generally a lack of evidence around skin tones in wound care, although it has been found that patients with dark skin tones are more likely to be diagnosed with higher-stage pressure ulcers (PUs; Oozageer Gunowa et al, 2018). This is due to a lack of accurate assessment and early identification (Oozageer Gunowa et al, 2018).

The recent Wounds UK Best Practice Statement titled "*Addressing skin tone bias in wound care: assessing signs and symptoms in people with*

*dark skin tones*" (Dhoonmoon et al, 2021) aimed to provide clinicians with practical guidance to aid accurate assessment and diagnosis in all skin tones, thus optimising patient care and improving outcomes.

While there was some evidence in the literature on dark skin tones and wound care, the Best Practice Statement expert group highlighted the lack of evidence and knowledge of skin tones in wound care.

## AIM

This article was suggested as a direct result of the Best Practice Statement process. The aim was to summarise the current literature on skin tone bias and wound care and to address the gaps in knowledge of dark skin tones, highlighting the need for further research.

## OBJECTIVES

- ▶▶ To summarise the current literature on skin tone bias and wound care
- ▶▶ To identify and address the gaps in current evidence
- ▶▶ To explore the implications for clinical practice
- ▶▶ To highlight and discuss the need for further research where appropriate.

Table 1. Search terms and total number of articles in the results

Search term	Total number of articles
Wound + skin tone	393
Wound + dark skin	90
Wound + pigmentation	1075
Wound + skin colour/color	153
Wound + black skin	206
Pressure ulcer + skin tone	18
Leg ulcer + skin tone	11
Diabetic foot ulcer + skin tone	5
Skin tear + skin tone	16
<b>Total number of relevant articles across all search terms</b>	<b>23</b>

## METHODS

A PubMed search was conducted in December 2021, aiming to identify articles on skin tones and wound care from 2016 to 2021. A variation of search terms were used to capture terminology around skin tone and included 'skin tone', 'dark skin', 'pigmentation', 'skin color/colour' and 'black skin'.

Search terms were also used to identify evidence on common wound types and skin tone, using the following search terms:

- ▶▶ Pressure ulcer + skin tone
- ▶▶ Leg ulcer + skin tone
- ▶▶ Diabetic foot ulcer + skin tone
- ▶▶ Skin tear + skin tone.

See *Table 1* for full information on the search terms and the results.

A total of 1967 papers were initially identified across all search terms. The search results were filtered for relevance to skin tone and wound care, resulting in a total of 23 papers. The majority of results that were filtered out related to sun damage and skin cancer risk, as opposed to directly relating to wound care. A significant number of articles were also about cosmetic skin procedures such as microdermabrasion, with references to 'uneven skin tone', for example, as opposed to the individual's skin tone.

The overall largest result (1075) came from searching for 'wound + pigmentation'; however, many of these papers referred to eye or hair pigmentation, and were not relevant to skin tone. There were also a significant number of papers on scarring and burns, which discussed pigmentation in terms of scarring rather than the individual's overall skin tone.

See *Table 2* for the articles identified in the

literature search that related directly to wound care and skin tone.

## ASSESSMENT AND SKIN TYPING

Several of the papers that were relevant to wound care and skin tone focused on skin typing, which classifies skin type according to the amount of pigment the skin has and its reaction to sun exposure. This has been used to help predict overall risk of sun damage and skin cancer. The Fitzgerald grading system was the most frequently mentioned (Gupta and Sharma, 2019; Sommers et al, 2019a; Fors et al, 2020; Ware et al, 2020). Use of the Munsell colour chart was also discussed (McCreath et al, 2016).

The limitations of the Fitzgerald grading system were explicitly explored (Ware et al, 2020). Additionally, it was found that the restricted range of options for people with dark skin tones within the Fitzgerald system does not capture variations in skin tone. This may result in inaccurate self-reporting, leading to unequal or inappropriate treatment in people with dark skin tones (Sommers et al, 2019a).

The paper discussing the Munsell colour chart found that it provided a 'more objective' measurement of skin tone (McCreath et al, 2016). However, the Best Practice Statement suggests that the Munsell colour chart may not be suitable for use in patient care, as its wide use in categorising colour in agriculture and archaeology means that it may have connotations of soil or 'dirt', which are not appropriate to use when working with patients and considering of skin tone (Dhoonmoon et al, 2021).

It should be noted that language and terminology are important in making sure that skin tone is discussed professionally and captured accurately (Trakatelli et al, 2017). Trakatelli et al (2017) found that the phrasing of questions (e.g. on sun sensitivity) can have a strong impact on the perception and reporting of skin phototype.

## PHOTOGRAPHING WOUNDS

Relating to skin assessment and typing, it was noted that accurate skin tone assessment is difficult in digital images (Terashima and Yoshimura, 2018). In this study, most nurses stated that assessing skin colour in digital images is difficult and that they did not think it could be a substitute for direct visual assessment. However, most nurses were in favour of including images in nursing progress notes.

**Table 2. Key points of articles identified in the literature search (23 articles)**

Article	Key points
Aloweni et al (2019)	More accurate and objective measurement is required to identify and diagnose an early category I PU or suspected DTI in adults with dark skin types 4 and above.
Bates-Jensen et al (2021)	An observational study of 270 PIs among 142 racially/ethnically diverse nursing home residents over 16 weeks. Results included: more Black individuals had persistent trunk and Stage 4 PIs; Black and Hispanic individuals had 'normal' skin color surrounding PIs; More Asian individuals had PIs surrounded by purple/red discoloured skin. More Black individuals' heel PIs were unstageable, necrotic, and showed no granulation. Black and Hispanic individuals exhibited more DTIs.
Black (2018)	No info available.
Black et al (2016)	Individuals with light skin tones present with 'classically defined' skin discolouration of purple or maroon tissue, a defined border around the area of injury, and often surrounding erythema is evident. Persistent erythema and hyperpigmentation, rather than blanching, should be used to determine PI in people with dark skin tone.
Fors et al (2020)	The FSPC showed an acceptable construct validity and a fair internal consistency. The five-item scale could potentially be used as an effective instrument for assessing skin phototype in people with dark skin tones.
Gupta & Sharma (2019)	Critical appraisal of skin typing methods.
Jennes et al (2018)	No info available.
Kibadi (2021)	Eighty-five percent of patients without complete wound closure at suture removal had history of use of skin-lightening products.
Mauck et al (2021)	Due to socioeconomic disadvantage and differences in skin absorption, Black Americans have an increased prevalence of Vitamin D deficiency. It is hypothesised that peritraumatic Vitamin D levels predict chronic pain outcomes after burn injury and contribute to racial differences in pain outcomes. Among burn survivors, peritraumatic Vitamin D levels were significantly more likely to be deficient in dark tone versus light tone individuals.
Mauck et al (2017)	African Americans have a higher risk of major thermal burn injury, and, in other clinical settings, African Americans experience a greater burden of pain and itch relative to European Americans. Skin graft site pain and itch severity was measured over 1 year in a prospective multicentre cohort sample of African Americans and European Americans. African Americans experienced a significantly slower rate of pain resolution in the acute phase of recovery, which resulted in a higher pain severity in the persistent phase of recovery, although not statistically significant after correction for multiple comparisons. African Americans also experience greater itch severity in 6 weeks to 12 months after burn injury compared with European Americans.
McCreath et al (2016)	Colour charts provide more objective measurement of skin tone than demographic categories. An objective measure of skin tone can improve PU risk assessment among individuals for whom current clinical guidelines are less effective.
Oozageer Gunowa et al (2020)	Documentary analysis confirmed all Higher Education Institutes overwhelmingly directed teaching and learning activities about PI towards people with light skin tones.
Oozageer Gunowa et al (2021a)	Classroom learning was predominately framed through a white lens with white normativity strongly reinforced through teaching and learning activities. This reinforcement of white normativity was evidenced through two main themes: (i) dominance of whiteness in the teaching and learning of pressure injuries in undergraduate nurse education and (ii) the impact and implications for student nurses of whiteness as the norm in pressure injury teaching.
Oozageer Gunowa et al (2021b)	This novel approach of using a single tool provides a unique opportunity to explore teaching materials and what is actually taught in the classroom. The data collected can assist with comparative analysis, enabling an in-depth view of curriculum content.
Oozageer Gunowa et al (2018)	There is a lack of guidance and evidence, and people with dark skin tones are more likely to develop higher stage PIs than people with light skin.
Rossman et al (2019)	No info available.
Sommers et al (2019a)	When self-reported FSPC are used for clinical skin assessment and sun cancer screening, they provide a restricted range of options for people with dark skin that does not capture variations in their skin colour. Inaccuracy of clinical data may lead to unequal treatment or inadequate cancer risk assessment.
Sommers et al (2019b)	Women with light skin tones may have skin that is more easily injured than women with dark tones. External genital injuries may be more easily identified in women with light skin compared to dark skin. These findings support the need to develop forensic procedures that are effective in people across the range of skin tones.
Terashima and Yoshimura (2018)	Most nurses stated that it is difficult to assess skin colour in digital images; they did not think it could be a substitute for direct visual assessment. However, most nurses were in favour of including images in nursing progress notes.
Trakatelli et al (2017)	Phrasing of questions on sun sensitivity can have a strong impact on the perception and reporting of skin phototype.
Walker et al (2020)	Epidermal thickness does not differ with obesity but the expression of genes encoding proteins associated with skin blood supply and wound healing were altered. In the obese, many gene expression pathways were broadly downregulated and subdermal fat showed pronounced inflammation. African American individuals differed from European Americans with a trend to increased epidermal thickening. There was altered gene expression in African Americans classified as obese compared to European Americans classified as obese that may explain known differences in water content and stress response.

*Table 2 continues overleaf*

Table 2 continued. Key points of articles identified in the literature search (23 articles)

Article	Key points
Ware et al (2020)	Anonymous survey of dermatologists and dermatology trainees to evaluate how providers use the FST in their clinical practice. Misuse of FST may occur more frequently among physicians who do not identify as having 'skin of colour'.
Zaidi (2017)	Differences in skin anatomy and physiology between light skin and dark skin may explain disparities in skin disorders and management of cutaneous disease.

DTI: deep tissue injury; FSPC: fitzpatrick skin phototype classification; PI/PU: pressure injury/pressure ulcer; FST: fitzpatrick skin type.

**SKIN PHYSIOLOGY**

One study examined differences in skin anatomy and physiology between skin tones, suggesting that this may contribute to disparities in skin disorders and provide insight into appropriate differences in the management of cutaneous diseases. The study concluded that it is important for clinicians to have knowledge of different races, geographical backgrounds, cultures and environments to enable effective diagnosis and treatment (Zaidi, 2017).

A further study examined whether both obesity and ethnicity alter gene expression in the skin. Findings showed that African American people differed from European American people, with a trend to increased epidermal thickening (Walker et al, 2020).

The authors observed altered gene expression in African American people classified as obese compared to European American people classified as obese, which may explain known differences in water content and stress response. Additionally, African American people showed markedly lower expression of the gene encoding the cystic fibrosis transmembrane regulator characteristic of the disease cystic fibrosis (Walker et al, 2020).

**WOUND TYPES**

It was expected that the literature would include more findings on PUs than other wound types. However, although there were more papers on PUs than other wound types, only 18 papers related specifically to skin tone and PUs. There were results for other wound types but none of these papers were found to be relevant to wound care and skin tone, so the only papers included on specific wound types focused on PUs.

A full literature review found that there is a lack of guidance and evidence on identifying PUs in individuals with dark skin tones, and that people with dark skin tones are more likely to develop higher-stage PUs in comparison to people with light

skin tones (Oozageer Gunowa et al, 2018).

In discussing differential diagnosis in suspected PUs, it was noted that persistent erythema and hyperpigmentation, rather than blanching, should be used to determine PUs in individuals with dark skin tones (Black et al, 2016).

A study on PUs in nursing home residents found differences in PU characteristics and highlighted the need for further study among diverse skin tones (Bates-Jensen et al, 2021). This study found significant differences in how PUs presented across race/ethnicity groups.

It was found that more Black and Asian individuals had peripheral vascular disease, and that more Black individuals had persistent trunk and Stage IV PUs. Black and Hispanic individuals had their normal skin colour surrounding PUs, whereas more Asian individuals had PUs surrounded by purple/red discoloured skin. More Black individuals' heel PUs were unstageable, necrotic, and showed no granulation (Bates-Jensen et al, 2021).

**DIAGNOSTIC TECHNOLOGY FOR PUS**

There were two papers that discussed the use of thermography or infrared technology to aid diagnosis of a PU, which may improve diagnosis in individuals with dark skin tones (Black, 2018; Aloweni et al, 2019). These papers identified the need for more accurate and objective measurement to identify and diagnose an early category I PU or suspected deep tissue injury in adults with dark skin tones, enabling early initiation of preventive measures in the hospital acute care setting.

It was also suggested that development of thermography or infrared technology may help to facilitate early intervention and reduce the risk of inaccurate assessment, resulting in disparities in health care.

**BURNS**

The two studies by Mauck et al (2017; 2021) focused

on outcomes following major thermal burn injuries. A study on pain and itch outcome trajectories found that African American people have a higher risk of major thermal burn injury, and that, in other clinical settings, African Americans experience a greater burden of pain and itch relative to European American people (Mauck et al, 2017). This study also evaluated skin graft site pain and itch severity (0-10 Numeric Rating Scale [NRS]) over 1 year in a prospective multicentre cohort sample of African American and European American people.

It was found that African American people experienced a slower rate of pain resolution in the acute phase of recovery (Mauck et al, 2017). African American people also experienced greater itch severity in 6 weeks to 12 months after burn injury compared with European American people, which resulted from a faster rate of itch development in African American people in the acute recovery phase after burn injury. It was concluded that future studies may improve outcomes in African American people and lead to new pathogenic insights that benefit all burn injury survivors.

A further study focusing on the effect of vitamin D levels on outcomes of major thermal burn injuries (Mauck et al, 2021) found that Black American people have an increased prevalence of Vitamin D deficiency, which was associated with chronic post-burn pain outcomes across all burn injury survivors, and accounted for approximately one-third of racial differences in post-burn pain outcome.

It was concluded that future studies are needed to evaluate potential mechanisms mediating the effect of Vitamin D on post-burn pain outcomes, and the potential efficacy of Vitamin D in improving pain outcomes and reducing racial differences.

#### **GENITAL INJURY AND SEXUAL ASSAULT**

Two papers focused on the effect of skin tone on identifying genital injuries following sexual assault (Rossman et al, 2019; Sommers et al, 2019b). These papers highlighted the importance of considering skin tone in such injuries during medical or forensic examination.

Genital injuries may be more easily identified in women with light skin tones compared to dark skin tones, which is of importance in both the healthcare and criminal justice systems. These findings support the need to develop procedures that are effective

in people across the range of skin tones (Sommers et al, 2019b).

#### **USE OF SKIN-LIGHTENING PRODUCTS AND WOUND HEALING**

One study by Kibadi (2021) examined time to removal of sutures from the palmar surface of the hand in individuals with dark skin tones. This study found that 85% of patients without complete wound closure at suture removal had history of use of skin-lightening products, raising the need for further research in this area, particularly in areas of the world where skin-lightening products may be more commonly used.

#### **EDUCATION**

Three papers by Oozageer Gunowa et al (2020; 2021a; 2021b) focused on education around skin tones.

Documentary analysis confirmed all Higher Education Institutes included in the study overwhelmingly directed teaching and learning activities about PU pressure injury towards people with light skin tones (Oozageer Gunowa et al, 2020).

Classroom learning was found to be predominately framed through a white lens, with white normativity strongly reinforced through teaching and learning activities (Oozageer Gunowa et al, 2021a). This reinforcement of white normativity was evidenced through two main themes: (i) dominance of whiteness in the teaching and learning of PUs in undergraduate nurse education; and (ii) the impact and implications for student nurses of whiteness as the norm in PU teaching.

Oozageer Gunowa et al (2021b) also documented the development of a structured tool for investigating teaching of PUs in people with dark skin tones. This novel approach of using a single tool was found to provide a unique opportunity to explore teaching materials and what is actually taught in the classroom. The data collected can assist with comparative analysis, enabling an in-depth view of curriculum content.

#### **CLINICAL IMPLICATION**

Health inequities have often been dismissed in healthcare with the assumption that this has been addressed and rectified (Moorley et al, 2020). However, from this literature review, it is evident



that people with dark skin tones are more likely to have poorer health outcomes than people with light skin tones.

From the assessments being used, to the education being delivered in the classroom, healthcare systems have been set up to fail people with dark skin tones and wounds. By not addressing skin tone diversity in wound care, clinicians and educators continue to perpetuate health inequities and deliver inadequate care, putting people's lives at risk.

### CONCLUSION

The lack of findings in the literature, plus the guidance in the Best Practice Statement document (Dhoonmoon et al, 2021), highlighted the relevance of skin tone in wound types in addition to PUs, and the need for more research across wound care. The results of this literature search confirmed that further research and evidence is needed around wound care and skin tones. The only relevant papers about specific wound types focused on PUs and, as the Best Practice Statement states, more evidence is needed around other common wounds to aid education and practice (Dhoonmoon et al, 2021).

There is a need for use of case studies and photographs of dark skin tones in general education around wound care to aid knowledge across the full range of skin tones, and to help address the gap in bias around light skin tones (Dhoonmoon et al, 2021).

### Declaration of interest

This article has been supported by Essity.

### REFERENCES

- Aloweni FAB, Ang SY, Chang YY et al (2019) Evaluation of infrared technology to detect category I and suspected deep tissue injury in hospitalised patients. *J Wound Care* 28(Sup 12):S9–16
- Bates-Jensen BM, Anber K, Chen MM et al (2021) Natural history of pressure injury among ethnically/racially diverse nursing home residents: The pressure ulcer detection study. *J Gerontol Nurs* 47(3):37–46
- Black J (2018) Using thermography to assess pressure injuries in patients with dark skin. *Nursing* 48(9):60–1
- Black JM, Brindle CT, Honaker JS (2016) Differential diagnosis of suspected deep tissue injury. *Int Wound J* 13(4):531–9
- Dhoonmoon L, Fletcher J, Atkin L et al (2021) *Addressing skin tone bias in wound care: assessing signs and symptoms in people with dark skin tones*. Wounds UK, London
- Fors M, González P, Viada C et al (2020) Validity of the Fitzpatrick skin phototype classification in Ecuador. *Adv Skin Wound Care* 33(12):1–5
- Gupta V, Sharma VK (2019) Skin typing: Fitzpatrick grading and others. *Clin Dermatol* 37(5):430–6
- Jennes S, Courtin C, de Cuyper LB (2018) Peculiarities of burns on dark skin [French]. *Rev Prat* 68(10):1096–8
- Kibadi K (2021) Time to removal of sutures from the palmar surface of the hand in dark-skinned patients: Results in a prospective cohort of 146 hands. *Hand Surg Rehabil* 41(1):142–8
- Limb M (2021) Disparity in maternal deaths because of ethnicity is "unacceptable". *BMJ* 372:n152
- MBRRACE-UK (2020) Saving lives, improving mothers' care. <https://tinyurl.com/2p8nrey7> (accessed 14 March 2022)
- Mauck MC, Barton CE, Tungate A et al (2021) Peritraumatic vitamin D levels predict chronic pain severity and contribute to racial differences in pain outcomes following major thermal burn injury. *J Burn Care Res* 42(6):1186–91
- Mauck MC, Smith J, Shupp JW et al (2017) Pain and itch outcome trajectories differ among European American and African American survivors of major thermal burn injury. *Pain* 158(11):2268–76
- McCreath HE, Bates-Jensen BM, Nakagami G et al (2016) Use of Munsell colour charts to measure skin tone objectively in nursing home residents at risk for pressure ulcer development. *J Adv Nurs* 72(9):2077–85
- Moorley C, Darbyshire P, Serrant L et al (2020) Dismantling structural racism: Nursing must not be caught on the wrong side of history. *J Adv Nurs* 76(10):2450–3
- Mukwende M (2020) Mind the Gap: a clinical handbook of signs and symptoms in black and brown skin. *Wounds UK* 16(3):16
- Oozageer Gunowa N, Brooke J, Hutchinson M, Jackson D (2020) Embedding skin tone diversity into undergraduate nurse education: Through the lens of pressure injury. *J Clin Nurs* 29(21–22):4358–67
- Oozageer Gunowa N, Hutchinson M, Brooke J, Jackson D (2018) Pressure injuries in people with darker skin tones: A literature review. *J Clin Nurs* 27(17–18):3266–75
- Oozageer Gunowa N, Hutchinson M, Brooke J et al (2021a) Pressure injuries and skin tone diversity in undergraduate nurse education: Qualitative perspectives from a mixed methods study. *J Adv Nurs* 77(11):4511–24
- Oozageer Gunowa N, Hutchinson M, Brooke J et al (2021b) Evidencing diversity: development of a structured tool for investigating teaching of pressure injury on people with darker skin tones. *Nurse Res* 29(2):17–24
- Rossmann L, Solis S, Rechin C et al (2019) The effects of skin pigmentation on the detection of genital injury from sexual assault. *Am J Emerg Med* 37(5):974–5
- Sommers MS, Fargo JD, Regueira Y et al (2019a) Are the Fitzpatrick Skin Phototypes valid for cancer risk assessment in a racially and ethnically diverse sample of women? *Ethn Dis* 29(3):505–12
- Sommers MS, Regueira Y, Tiller DA et al (2019b) Understanding rates of genital-anal injury: Role of skin color and skin biomechanics. *J Forensic Leg Med* 66:120–8
- Terashima T, Yoshimura S (2018) Skin colour assessment of replanted fingers in digital images and its reliability for the incorporation of images in nursing progress notes. *J Clin Nurs* 27(5–6):e1225–32
- Trakatelli M, Bylaite-Bucinskiene M, Correia O et al (2017) Clinical assessment of skin phototypes: watch your words! *Eur J Dermatol* 27(6):615–9
- Walker JM, Garcet S, Aleman JO et al (2020) Obesity and ethnicity alter gene expression in skin. *Sci Rep* 10(1):14079
- Ware OR, Dawson JE, Shinohara MM, Taylor SC (2020) Racial limitations of Fitzpatrick skin type. *Cutis* 105(2):77–80
- Zaidi Z (2017) Skin of colour: Characteristics and disease. *J Pak Med Assoc* 67(2):292–9