J Wound Ostomy Continence Nurs. 2023;50(2):107-114.
Published by Lippincott Williams & Wilkins

NCPD 2.5 ANCC Contact Hours

VIDEO ABSTRACT

Assessment and Identification of Skin Disorders in Skin of Color

An Integrative Review

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ABSTRACT

Skin assessment in patients with dark skin tones (DST) continues to be a challenge for many healthcare providers (HCP) because the visual cues are not always readily identified. For example, identification of early signs of pressure injury when subtle skin color changes are missed has the potential to cause harm and contribute to healthcare disparities. Appropriate wound management can begin only when the wound is correctly identified. For HCPs to identify early signs of skin conditions in DST patients, they must be provided education and effective tools enabling them to identify clinically relevant signs of skin damage in all patients. This article reviews basic anatomy of the skin; it focuses on differences seen in DST and reviews assessment strategies to assist the HCP to identify skin changes and conditions.

KEY WORDS: Dark skin tones, Incontinence-associated dermatitis, Pressure injury, Skin assessment.

INTRODUCTION

Skin assessment in patients with dark skin tones (DST) is a challenge for many healthcare providers (HCP). Nevertheless, accurate classification of skin injuries and identification of their etiology are paramount.[1,2] Assessment of the skin includes assessment of skin tone.[3] For example, when assessing anemia, the HCP will look for the patient for reduced color or pallor; when assessing for hypoxia, the HCP will look for cyanosis; and when assessing a patient who reports trauma, the HCP will examine the skin for ecchymosis. The character of skin color changes will differ based on the patient's underlying skin tone and these differences may not be easily identified in persons with DST without proper education in persons with a variety of skin tone. This is especially evident in the identification of early signs of pressure injury when missing changes in skin tone has the potential to cause harm and can contribute to healthcare disparities.

Skin color is a socially sensitive issue and a potential source of discrimination. Most HCPs perceive themselves as "color blind" and strive to treat every patient with dignity and respect. However, it is theorized that striving for "color blindness" may have a negative impact on health outcomes in patients with DST. Marilyn Sommers[4] asserted that HCPs should not ignore the relevance of skin color because patients may not want to be treated as having no particular race or color. The application of color awareness in health assessment and in skin assessment by the HCP can improve outcomes and reduce disparities in healthcare delivery.

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Conflict of interest: *The author declares no potential conflicts of interest, financial or otherwise.*

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DOI: 10.1097/WON.0000000000000960

The 2020 United States Census Data indicate that there is a substantial shift in racial diversity with 4 out of 10 respondents identifying as "other than white."[5] We know that the US population is increasingly diverse with increases in Asian, Hispanic, African, and Caribbean cultures. As a result, HCPs should expect an increasingly diverse patient population and must be provided the knowledge and resources needed to identify skin irregularities in all skin tones. The purpose of this integrative review article is to review normal skin anatomy in DST, discuss assessment tips that may improve identification of skin irregularities in persons with a variety of skin tones, and present several case studies involving skin lesions in DST.

Bates-Jensen and colleagues[6] hypothesized that failure to detect blanchable and nonblanchable erythema in patients with DST increases the patient's risk of developing a full-thickness skin injury. Racial disparities in pressure injury incidence are well documented.[7-10] Sommers and colleagues[11] evaluated health disparities in forensic sexual assault examinations and found differences in detection of trauma to the skin based on skin color. This potential disparity was echoed in a study conducted that compared the ability of forensic pathologists to identify blunt trauma injuries in DST versus light skin tones where researchers found fewer injuries identified in DST as compared to White victims.[12] Researchers also found significant disparity in images in dermatologic and medical textbooks and journals that may be contributing to disparity in skin injury identification in DST.[13,14] More diversity in these images is needed to help guide HCPs to properly characterize skin lesions in patients with DST.

The development of skin injuries, such as incontinence-associated dermatitis (IAD) and pressure injuries is associated with the quality of nursing care.[15-17] It is estimated that 2.5 million pressure-induced injuries are treated annually in US hospitals.[18] Pressure injuries (PIs) are associated with impaired health-related quality of life and increased risk of hospital readmissions, along with increased morbidity and mortality.[17,19-24] They are

also costly; the United States Agency for Healthcare Research and Quality estimates that a pressure injury increases the cost for a single patient's hospital course by US $43,000, and estimates of cumulative costs for hospital-acquired pressure injuries are approximately US $11.6 billion annually.[22-24] Research suggests that people with DST experience higher rates of full-thickness PI as compared with lighter skin toned individuals.[9,10,24-26] Approximately 60,000 patients die each year as a result of PI complications, and mortality rates were reported to be higher among African Americans than in persons of other ethnic groups.[23,24,26]

Incontinence-associated dermatitis is a form of irritant contact dermatitis or moisture-associated skin damage; it is characterized by erythema with or without erosion of the skin when the skin is exposed to urine or fecal matter.[27] Prevalence rates of IAD vary according to healthcare setting; these rates vary from as low as 3.4% to 25% or even higher.[2,28,29] Research links incontinence and IAD to an increased risk for developing full-thickness pressure injuries.[16,28,30] Similar to our experience with early detection of pressure injuries, IAD may not be identified in timely manner because the erythema may be difficult to detect in persons with DST.

ANATOMY OF THE SKIN

The skin is the largest and most visible organ on the human body; it is divided into epidermis and dermis.[31-33] The epidermis is the avascular outermost layer; it is multilayered and renews itself by cell division in the deepest layers of epidermis. The epidermis derives its nutrition from the dermis. Epidermal layers are the stratum corneum, the stratum lucidum, the stratum granulosum, the stratum spinosum, and the stratum germinativum (stratum basale).

The stratum corneum consists of dead keratinized cells that are layered in stacked formation, embedded in a lipid matrix forming a "brick & mortar" (epithelial) barrier to moisture and irritants.[31,32] Alterations in the lipid content of the stratum corneum are believed to be responsible for some skin disorders.[33] Research indicates that persons with DST have more compact cells, more layers, greater intercellular cohesion, and increased junctional integrity than the stratum corneum of persons with lighter skin tones.[32,33]

The stratum lucidum lies directly below stratum corneum; it is found in area of the body where the epidermis is thicker, such as the soles of the feet and palms of the hands.[32,33] The cells in this layer are not yet flattened and still have nuclei. The stratum spinosum lies below the stratum granulosum; it is often described as the prickly layer. Prominent features include the desmosome, a type of cell-cell junction that provides adhesion between cells and resistance to mechanical forces. The identification of various proteins in desmosomes has been linked to various epidermal pathologies, such as bullous impetigo and pemphigus vulgaris.

The innermost layer of the skin, often referred to as the basal layer, is a single layer of mitotically active cells and the area where cutaneous metabolism occurs.[32,33] Cells formed in the basal layer migrate upward to the stratum corneum, usually over a period of 2 to 3 weeks. Melanocytes, the cells responsible for skin pigmentation, are found in this layer. They have dendrites with pigment containing organelles, called melanosomes.[31,32] Under normal conditions, the number of melanocytes is nearly the same regardless of skin color.[32,33] Variability in skin tones is attributable to the size, number, and distribution of the melanosomes, the structure containing melanin pigment, and activity within the melanocytes.[31-33] In persons with DST, the melanosomes are distributed throughout the epidermis, while they are not seen in stratum corneum of light-skinned individuals.

The synthesis of Vitamin D in skin occurs in presence of sunlight as ultraviolet (UV) radiation converts a sterol to Vitamin D.[33] Vitamin D is believed to be important in bone mineralization and is considered an active hormone when converted to calcitriol. It is also thought to impact mood and cognitive status and may offer protection against cardiovascular disease diabetes and some cancers. Because melanin is photoprotective, the synthesis of Vitamin D is lower in DST persons and higher in those with lightly pigmented skin. Therefore, vitamin D supplementation may be beneficial for persons with DST. However, Vitamin D levels should be assessed before recommending supplementation.

SKIN CLASSIFICATION/TYPING

Jackson-Richards and Pandya observed skin tones encompassing multiple racial and ethnic groups, including Asians, Hispanics, Middle Easterners, Native Americans, Pacific Islanders, and persons of African descent.[32] They further asserted that while these individuals can be classified as Fitzpatrick phototype IV, V, or VI, the range of skin tones among individual human beings is infinite. Nevertheless, skin typing and color charts were designed to differentiate skin tones for clinical and investigational purposes, and the National Pressure Injury Advisory Panel (NPIAP) suggests using an objective system when describing skin tones or colors rather than reliance on ethnic labels.[16] Examples of more widely used skin-typing charts are the Fitzpatrick, Massey-Martin, and Munsell skin tone charts.[34]

Skin color can also be described as constitutive versus facultative.[35] Constitutive skin color represents an individual's baseline color (color of skin that has not been affected by sun or other UV exposure). The facultative skin color comprises skin that is sun exposure or UV exposure, resulting in increased melanin production and a different skin tone than constitutive.

The Fitzpatrick skin classification system was developed in 1970s and it is based on an outdoor sunscreen study completed in Australia in 1972.[35,36] Their original research was designed to evaluate a person's susceptibility to sunburn; study participants comprised a non-Hispanic White population. Skin tones were compared before and following sun exposure for 60 minutes. The study was designed to calculate dosing of UVA of phototherapy and included only 3 categories. Type I comprised persons whose skin burned easily and did not tan at all; type II was assigned to those who sunburn easily and tanned with difficulty; and type III comprised those who sunburn moderately and have immediate pigment change with moderate tan. The categories were expanded in 1975 to be more useful in phototherapy; this expansion included the person's response to the first unprotected sun exposure using a questionnaire resulting in addition of a categories IV.[35] However, both studies excluded persons with DST. Black and brown skin classification types V and VI were ultimately added based on skin color rather than reactivity to sun exposure (Table).[35,36] One criticism of this system is rooted in the fact that it was developed to identify erythema primarily in light skin and is not easily translated to persons with DST, with or without erythema.[35]

TABLE.
Fitzpatrick Skin-Type Classification System[33,34]

Skin Type	Typical Features	Tanning Ability
I	Pale, white skin, blue/green eyes, blond/red hair	Always burns, does not tan
II	Fair skin, blue eyes	Burns easily, tans poorly
III	Darker white skin	Tans after initial burn
IV	Light brown skin	Burns minimally, tans easily
V	Brown skin	Barely burns, tans darkly easily
VI	Dark brown or black skin	Never burns, always tans darkly

The Massey-Martin skin color scale was developed in 2003; it was designed as an instrument for use in social surveys to identify racial disparities.[37] The Massey-Martin skin color scale is an 11-point scale that used illustrations of hands to depict skin tones ranging from zero to 10, with zero representing albinism (total absence of color) to 10, which represents the darkest possible skin tone (Figure 1). The scores are assigned by a research; this process is subjective; and evidence indicates that the skin tone of the researcher influences scores assigned to study participants.[38]

The Munsell color chart is numerical system used to describe and compare colors (Figure 2). It is divided into alphanumeric designations based on qualities of hue, value, and chroma (intensity of a particular color).[39] Munsell charts have been used to identify and describe a variety of colors in building, painting, and art; it is used to assess skin discoloration. McCreath and colleagues evaluated the validity of the Munsell color chart in describing patient skin tone categories compared to ethnicity and race to predict pressure injury risk.[37] They found that the Munsell color chart can be used to assess a broad array of skin tones more accurately than patient ethnicity.[37] They further observed that minimal time was required to train the staff to use this instrument and it was effective for identifying subtle changes in skin tones. Considered collectively, additional evaluation of the validity and reliability to these instruments is needed and staff education is required before application of an instrument for typing skin tones in the clinical setting.

SKIN ASSESSMENT

A comprehensive history is an essential preamble to accurate skin assessment.[26,40,41] For example, knowledge of mobility status and urinary/fecal continence status provides guidance toward a differential diagnosis of pressure injury versus IAD or other forms of moisture-associated skin damage (Box). Since early signs of skin color change may be missed in DST without proper education and resources, it is important to obtain a timeline of any pressure-related events, combined with a high index of suspicion when performing a skin assessment, particularly in persons with darker skin tones.[26,40,41]

BOX.

Additional Resources and Links for Skin Assessment in Persons With Dark Skin Tones

- Brown Skin Matters: https://brownskinmatters.com
- Skin Deep a DFTB Project: https://dftbskindeep.com
- DermNet NZ: https://dermnetnz.org
- National Pressure Injury Advisory Panel (NPIAP): https://npiap.com
- Wound, Ostomy, and Continence Nurses Society: https://www.wocn.org

Ensure adequate lighting when assessing the skin to enable detection of subtle changes in skin color. Appropriate lighting with natural light, halogen lamp, or a flashlight is especially important for inspecting DST. You want to avoid fluorescent lighting, which may cast a bluish tint on dark skin.[4,26,42] In addition, thoroughly cleansing the area is recommended to remove fecal effluent or nontransparent skin care products that may impair the clinician's ability to detect changes in skin tones.

When assessing, compare the skin color surrounding any area of concern and compare the area of concern to the patient's constitutive (baseline color) color.[26,41-43] For example, compare the skin color of the sacrum to the patient's inner arm or abdomen. Next, palpate for presence of edema and assess for induration (hardness) or for any change in temperature.[26,40-43] Injury to skin and soft tissue produces an inflammatory response that includes changes in local skin temperature and induration.[4,26,40,42] As the affected skin changes color, it tends to feel warmer to palpation; in contrast, adjacent, intact skin may feel cooler. I recommend using the back of your hand to evaluate local temperature changes. Although gloves may diminish this sensitivity and the ability to feel this change in temperature, universal precautions should be maintained. Because darkly pigmented skin is higher in lipid contact, so moistening the skin can enhance the assessment.[26,32,33,40] The higher lipid content can make darker skin susceptible to greater transepidermal water loss and xerosis, resulting in dry, scaly, and ashen skin.[26,40]

In addition to these characteristics, the skin should be assessed for pain or discomfort in areas over bony prominences. Pain may be a sign of pressure injury, while burning may be a sign of irritant contact dermatitis secondary to incontinence (IAD).[42,44] The clinician should also remember that patients with decreased sensation may not be able to feel discomfort, reducing the predictive power of this component of skin assessment. In addition to visual inspection, emerging technologies, such as thermography and subepidermal moisture (SEM) measurements, may help increase early identification of skin injury in DST.[41]

Figure 1. The Massey-Martin Skin Color Scale.[36] From Massey and Martin.[35]

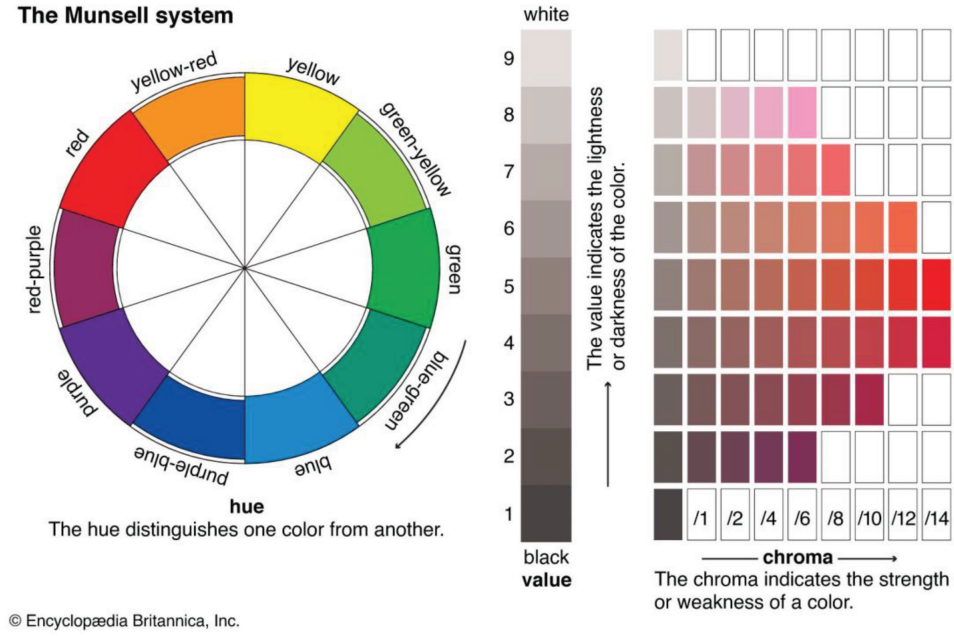

Figure 2. The Munsell system has been used to assess blue and red skin discolorations in nursing residents at risk for pressure injury (PI) development.[39] From https://www.britannica.com/science/Munsell-color-system/images-videos#/media/1/397642/148652.

PRESSURE INJURY VERSUS IAD

Pressure injuries are classified using a staging system that is based on depth of tissue injury and incorporate the current understanding of the science of pressure injury pathology and etiology.[45,46] Other injuries can be classified as either full thickness or partial thickness, depending on the depth of tissue damage in the wound. Characteristics of darker skin tones include higher lipid content and the presence of a greater number of melanosomes in the stratum corneum when compared to levels of lipid and melanosomes in light skin.[32,33] These differences can mask color contrasts seen with erythema in persons with lighter skin tones and may cause inflammation to appear as violet-black or black in tone.[26,32,40] Because persons with DST have increased melanin, the appearance of blanching may also be muted creating challenges in identification of early skin injuries.[32,42] Additional elements of the skin assessment to aid in differential diagnosis of pressure injury versus IAD include the location of the lesion (pressure injuries tend to occur over bony prominences or in conjunction with the use of medical devices while IAD occurs in areas of the skin exposed to fecal or urinary incontinence), borders of the skin damage, and a history that includes presence of incontinence (essential for a diagnosis of IAD) or risk factors for pressure injury including mobility. Figures 3 to 13 illustrate the various stages of pressure injury and IAD in persons with DST.

Research indicates that emerging technologies, such as thermography and SEM, may help increase early identification of skin injury in DST. Thermography is a noninvasive, noncontact method for measuring temperature differences between area of concern and the adjacent skin. A handheld device uses inferred radiation to create a 2-dimensional image using grades of color producing a visual representation of tissue perfusion and areas of ischemia.[42] Subepidermal moisture

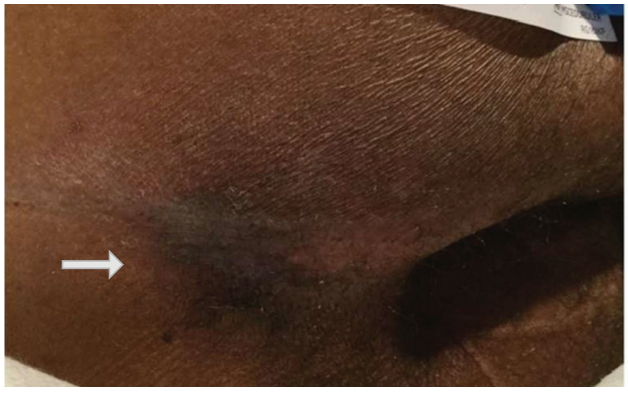

Figure 3. Stage 1 pressure injury on sacrum characterized by nonblanchable erythema of intact skin. Note the darkened area over bony coccyx in this patient with dark skin tones. This patient was in immobile status post–fractured hip repair and reported pain in sacral area.

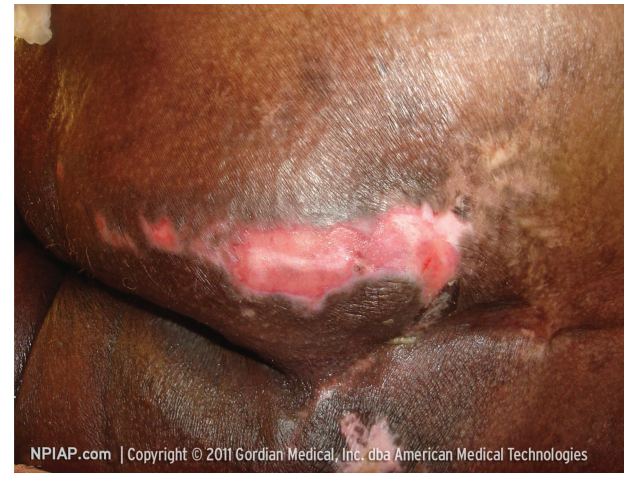

Figure 4. Stage 2 pressure injury on sacrum. Once the epithelial layer is eroded, the wound is easier to identify. This patient had a history of immobility and reported pain in the area.

Figure 5. Stage 3 pressure injury on sacrum. This is a full thickness injury.

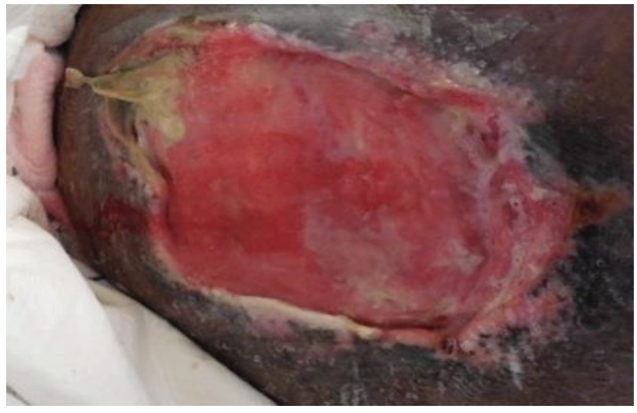

Figure 6. Stage 4 pressure injury on sacrum. Full-thickness skin and tissue loss with exposed or directly palpable fascia, muscle, tendon, ligament, cartilage, or bone in the ulcer.

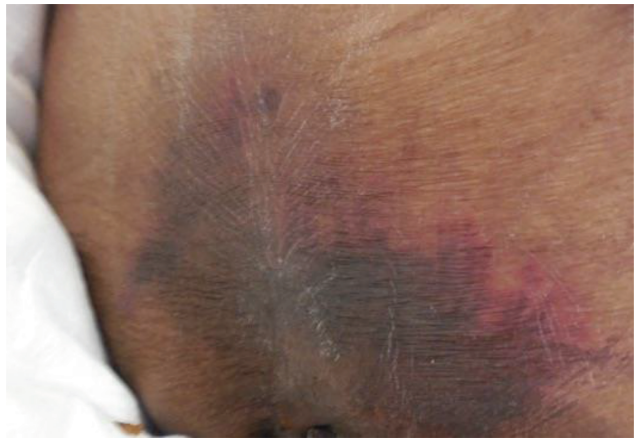

Figure 7. Deep-tissue pressure injury on sacrum. Note the erythema surrounding margins. Initially, this was thought to have ischemic component, but this patient did not have history of hypotension or hypoxia. The patient's history was significant for being found on the ground at home after a fall for an undetermined amount of time. This patient also had a history of rhabdomyolysis.

technology measures moisture content in tissue below the stratum corneum.[26,41,47] Limited evidence suggests that the SEM

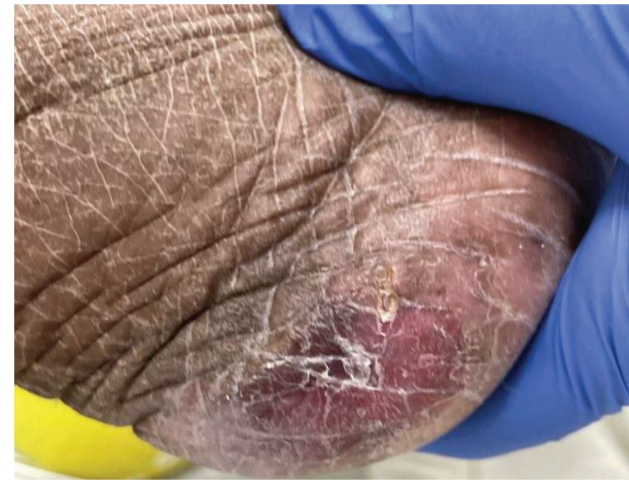

Figure 8. Deep-tissue injury on heel. Note that dry, xerosis covered desiccated dark fluid colored blister with maroon discolored margins. This patient was immobile and unable to lift her heels off the bed.

measurement via a handheld device can identify early edema and early pressure injury.[47-49] Global guidelines for pressure injury prevention recommend skin temperature assessment or SEM as an adjunct to the clinician's physical assessment to enhance the identification of early skin injury, especially in patients with DST.[19] Additional research is needed to determine the efficacy of these technologies and to define their role in skin assessment and pressure injury prevention.

OTHER SKIN DISORDERS

Pressure injury and irritant contact dermatitis are not the only skin disorders that may be missed when assessing persons with DST. Additional examples of conditions whose presentation varies based on skin tone include atopic dermatitis (AD) (eczema) and psoriasis. Atopic dermatitis is one of the most prevalent inflammatory skin conditions (dermatosis); clinical manifestations usually include erythematous dry patches,

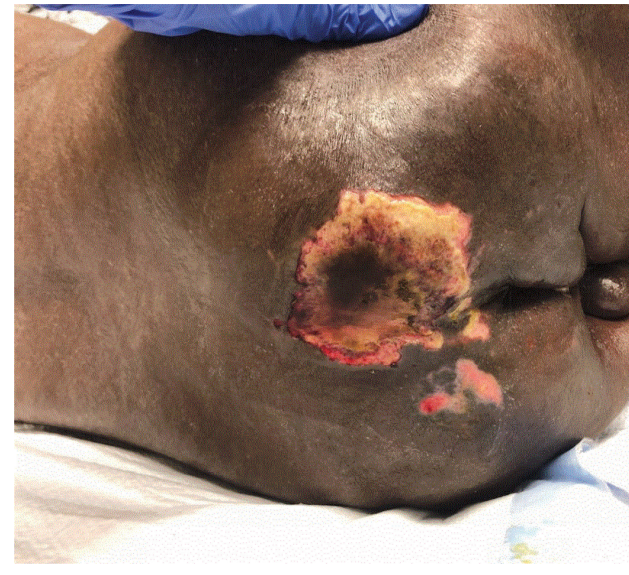

Figure 9. Unstageable pressure injury of sacrum. Full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar.

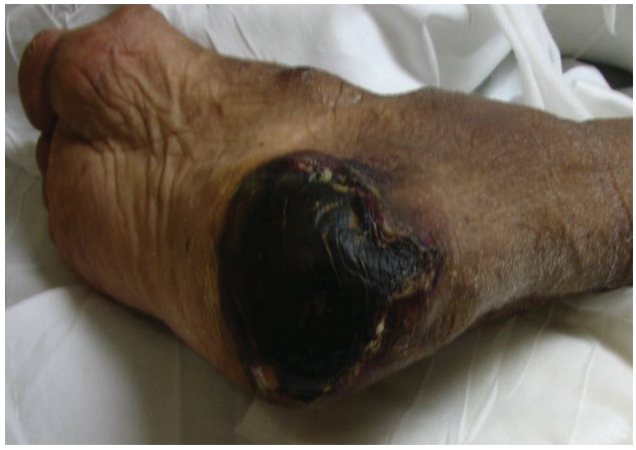

Figure 10. Unstageable pressure injury on heel. This is a dry stable hard eschar-covered lesion with clearly demarcated margins on heel. If the wound is not fluctuant, it is recommended to keep dry as the eschar is acting as protective cover.

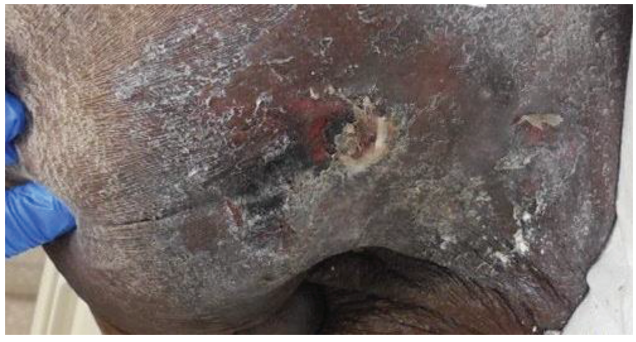

Figure 11. Irritant contact dermatitis secondary to incontinence and moisture on buttock and sacrum. Notice the diffuse margins, the areas of epithelial erosion, and the dry, scaly skin. This patient was ambulatory with history of c-difficile diarrhea. The patient reported "burning and itching" in area.

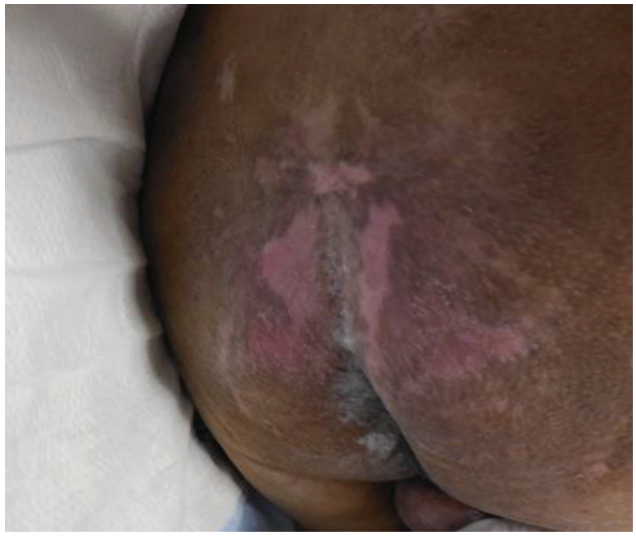

Figure 12. This is an example of hypopigmented skin. Hypopigmentation occurs when skin injury is re-epithelialized. When the hypopigmentation is in area that is visible, it may be an unsettling to the individual.

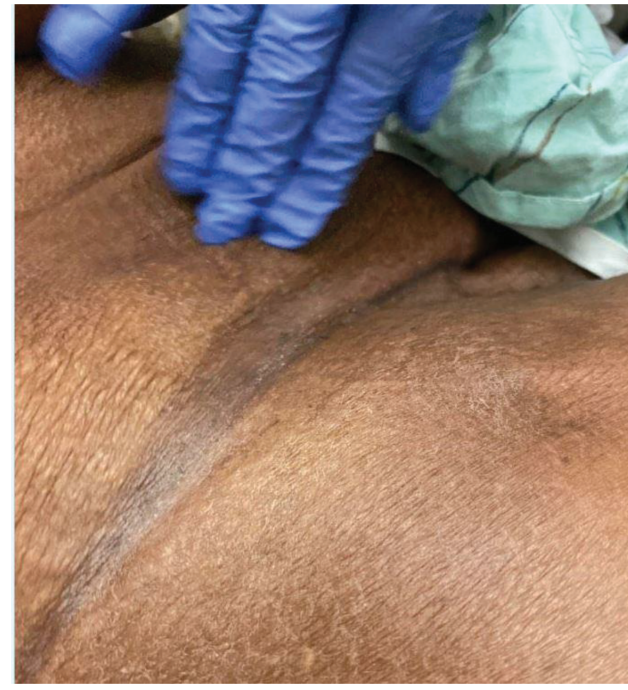

Figure 13. Intertrigo in abdominal pannus fold. Note darker discoloration in fold. This patient reported itching in this area.

fine scaling, and pruritic lesions (Figures 14 and 15).[50] I have found that assessment of the erythema associated with AD is particularly challenging in persons with DST. Although the etiology of AD is not clearly understood, it is believed to be caused by a complex interplay of genetics and environmental factors; its prevalence is higher in persons with DST and those living in urban environments. Postinflammatory hypo- or hyperpigmentation occurs more commonly with DST and

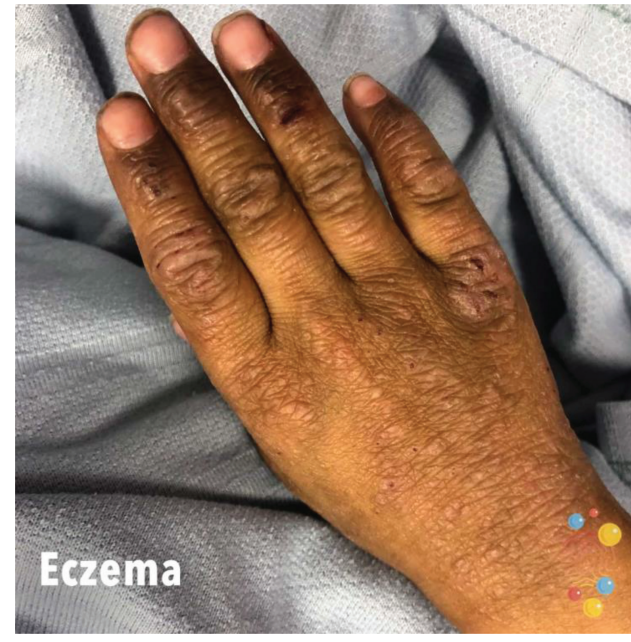

Figure 14. Eczema or atopic dermatitis. Note the scaly patches postinflammatory hypopigmentation and extensive lichenification. Reproduced with permission from Skin Deep a DFT Project: https://dftbskindeep.com 2022.

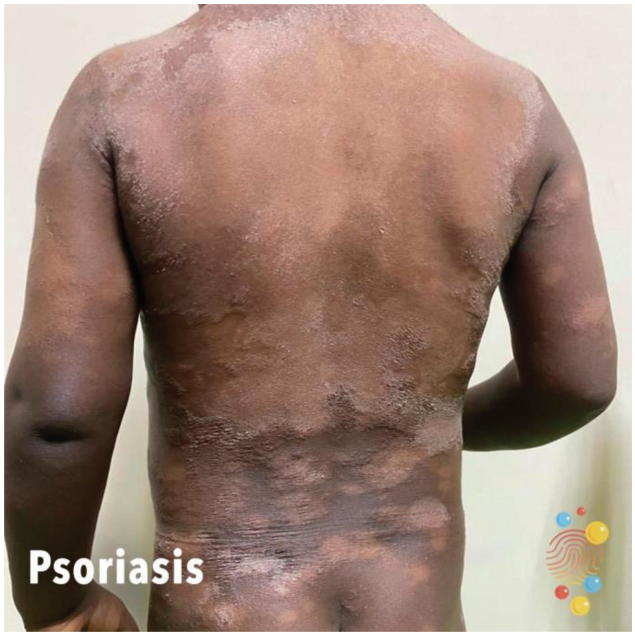

Figure 15. Psoriasis on this patient's back. Note the generalized diffuse plaque rash with areas of lichenification and postinflammatory hypo- and hyperpigmentation. Reproduced with permission from Skin Deep a DFT Project: https://dftbskindeep.com 2022.

can be more noticeable than in persons with lighter skin tones, resulting in significant psychological distress. A detailed discussion of treatment is beyond the scope of this integrative review; management usually includes application of moisturizers that contain ceramides or petroleum, along with referral to dermatologist for additional topical or system treatments.

Psoriasis is a chronic immune-mediated inflammatory skin condition characterized by clearly defined, red and scaly plaques.[49,50] Lesions usually present as erythematous areas with thickening and scale.[50] These lesions may be missed in early stages in persons with DST. Approximately 230 million people around the world have AD; the prevalence rate among African Americans is around 1.3% versus 2.5% in White Americans.[49,50] It typically affects people with an atopic tendency; these individuals may also experience seasonal allergies (hay fever), asthma, and food allergies.[49] Clinical manifestations for psoriasis are similar among all races and ethnicities; however, little research exists regarding psoriasis in non-White populations. Psoriasis has a strong genetic component that affects the regulation of the immune system.[49,50] Persons with psoriasis have been found to be at higher risk of metabolic syndrome, depression, cancer, myocardial, and vascular diseases; nevertheless, the nature of the relationships among these conditions remains unclear.[50] Treatments for psoriasis include combination therapy such as topical and systemic glucocorticoids, retinoids, phototherapy, immunosuppressants, and biologics that target T cells. Referral to dermatologist is indicated for ongoing management.

CONCLUSIONS

Healthcare professionals must have the knowledge and resources to identify skin irregularities in all patients, regardless of their constitutive and facultative skin tones. Additional research is needed to provide guidance for the assessment and management of various forms of skin damage in patients with DST. This research should address further development and validation of novel or existing instruments for evaluating various skin tones and refinement of newer technologies to support visual inspection of the skin. Additional knowledge of skin anatomy and the differences in the presentation of common clinical manifestations of skin conditions such as erythema, inflammation, and edema in persons with DST is needed to improve the accuracy of diagnosis and subsequent management. I recommend the use of good lighting, taking time to compare skin color and temperature to surrounding area, and palpation for induration when assessing the skin. I further recommend use of adjunct technology to assist the practitioner when assessing DST.

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Assessment and Identification of Skin Disorders in Skin of Color: An Integrative Review

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DOI: 10.1097/WON.0000000000000969