



**Conceptual and Clinical Look at Pressure Injuries
in Darkly Pigmented Skin**

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Objectives

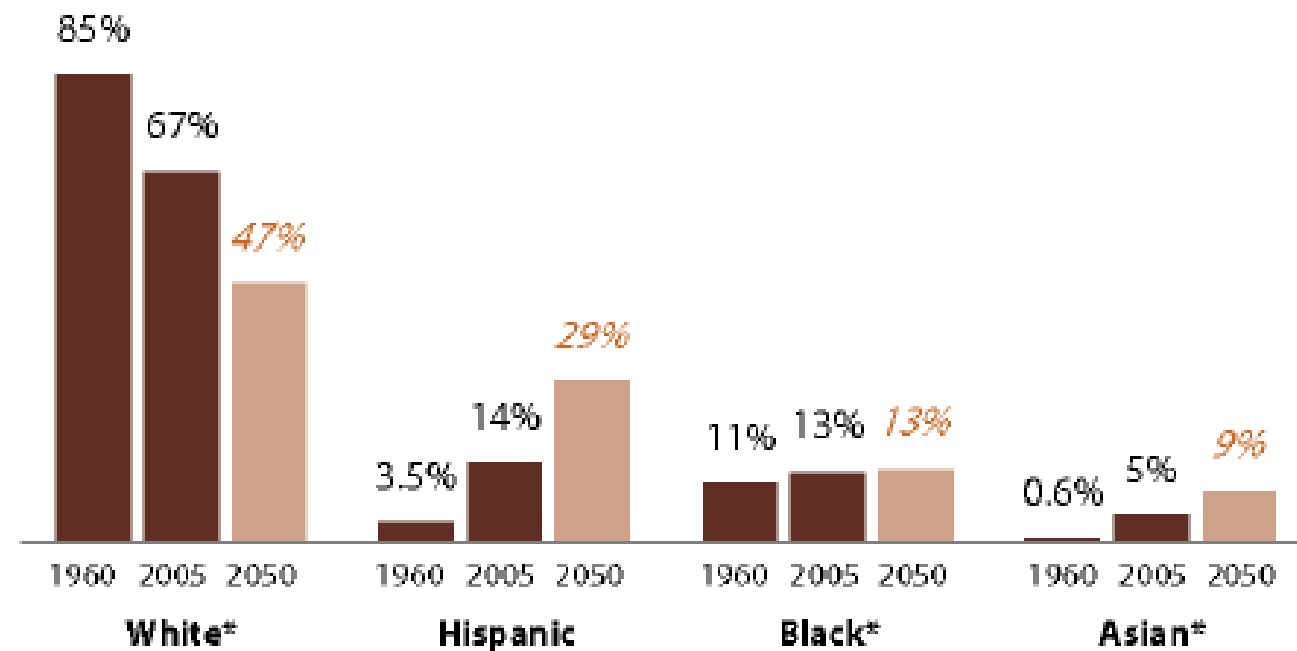
- Define 'persons of color'
- Describe physiological differences in skin of persons with darker skin tones
- Discuss various scales that are used to identify skin color pigment or tone differences
- Identify commonly missed risk factors of pressure-related injury in darker- skinned individuals
- Describe early skin changes related to pressure injury that may not be visible in persons of darker skin tone colors
- Identify appropriate steps towards pressure ulcer prevention in persons with darker skin tones

Significance

- By the year 2050, individuals with skin of darker color (including Africans, African Americans, Asians, Native Americans and Hispanics) will comprise more than half of the U.S. population (Hampton University Skin of Color Research Institute (HUSCRI) <http://huscri.hamptonu.edu/>)
- The heterogeneity among persons with skin of darker color is best explained via the differences in the structure, function and physiology of the skin and hair (Lawson et al. 2017).

Figure 6

Population by Race and Ethnicity, Actual and Projected:
1960, 2005 and 2050
(% of total)



Note: All races modified and not Hispanic (*); American Indian/Alaska Native not shown.
See "Methodology." Projections for 2050 indicated by light brown bars.

Source: Pew Research Center, 2008

Color Awareness: A Must for Patient Assessment

- Skin is largest organ of the body
- Skin is first thing clinicians notice about a patient. Therefore, it should be key area of focus for health care providers (Lott, 1998)
- Traditionally, nurses evaluate color of patient's skin as significant measure of overall health status (pallor, cyanosis, flushing, redness, bruising, birth marks, rashes, blanching) but not typically evaluated skin tone related to PU/I risk
- Clinicians also evaluate skin for signs of breakdown or potential loss of integrity, and assess wounds in various stages of healing – this evaluation could be individualized based on skin tone

Health Care Disparities

Regarding persons with darker color skin, health disparities exist related to adequate assessment of skin injury

Clinical treatment may be delayed until later stages of injury are visible, this may result in:

- Underdiagnosed co-morbidities
- Delay in implementation of pressure injury intervention strategies
- Increased length of stay of hospital stays
- Increased mortality

References: Sommers, 2009; McCreath et al., 2016; Bates-Jensen et al., 2017)

Persons of Color versus Color of Skin

- “The use of physical characteristics (e.g., gender or skin color) to distinguish a cultural group or subgroup is inappropriate” (Ball et al., 2019).
- There is a significant difference between distinguishing cultural characteristics and distinguishing physical characteristics (Ball et al., 2019).
- Skin pigmentation or skin tone color is a physical characteristic, not a cultural one.
- All persons are “Persons of Color,” we just display varying degrees of skin pigmentation or skin tone color. Persons with darker skin tone (DST) have unique skin needs.

Skin Color

- Skin color is defined “the perceived pigmentation resulting from selective absorption and scattering of light from the dermis of the body” (Pierard, 1998).
- Skin color includes a combination of body location and physiological occurrences within the topmost layers of the skin (Everett, Budescu, Sommers et al., 2012).
- Contributing factors skin color: **melanin**, chromophores, carotene, oxygenated hemoglobin and reduced hemoglobin.

Stratum corneum

Stratum
lucidum

Stratum
granulosum

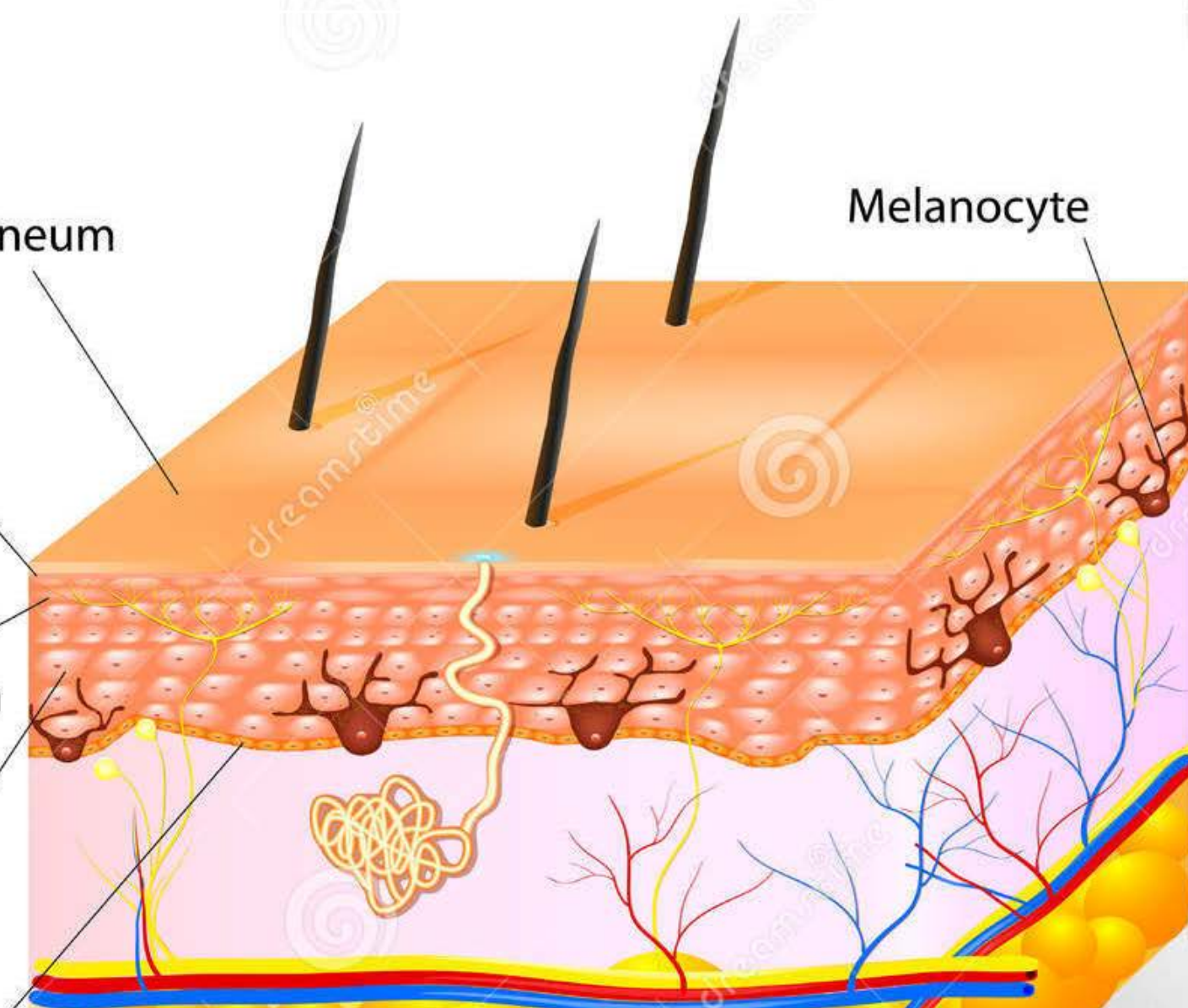
Stratum
spinosum

Melanocyte

Epidermis

Dermis

Hypodermis



Skin color

- Normal skin color is composed of a mixture of 4 biochromes (biological pigments)
 1. **Reduced hemoglobin (blue)**
 2. **Oxyhemoglobin (red)**
 3. **Carotenoids (yellow, exogenous)**
 4. **Melanin (brown)**
- The color of skin is primarily genetically determined and is largely the result of the insoluble polymeric pigment melanin which is produced by **melanocytes** in the highly specialized organelle known as the **melanosome**

Reference: Everett, Budescu, Sommers et al., 2012

Skin color

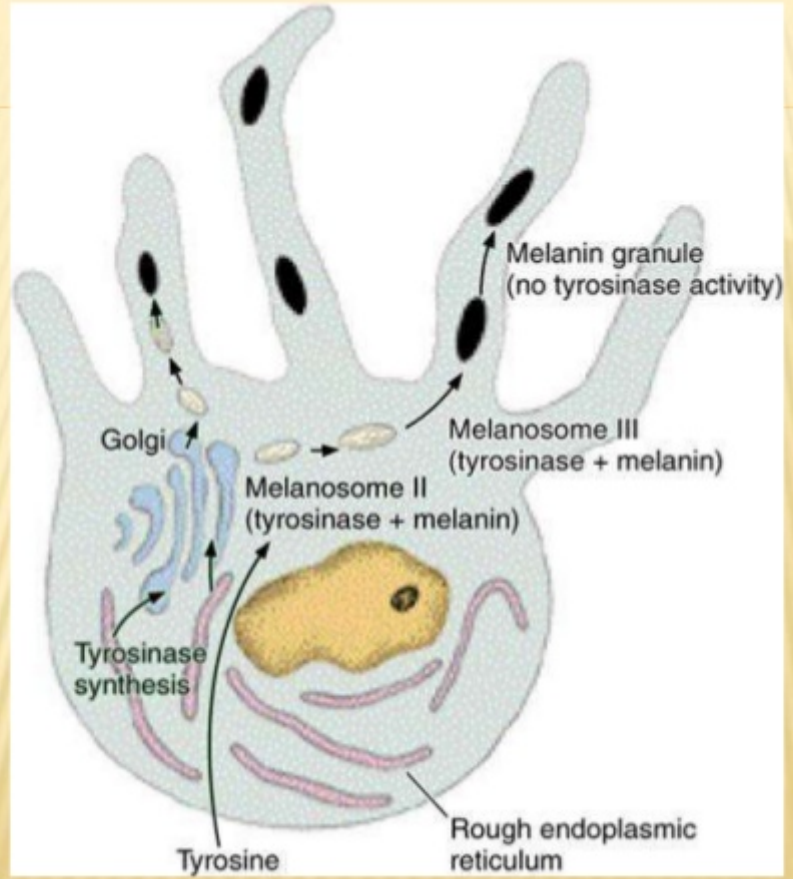
- Melanocytes synthesize 2 chemically distinct groups of melanin:

Nitrogenous eumelanin (black to brown)

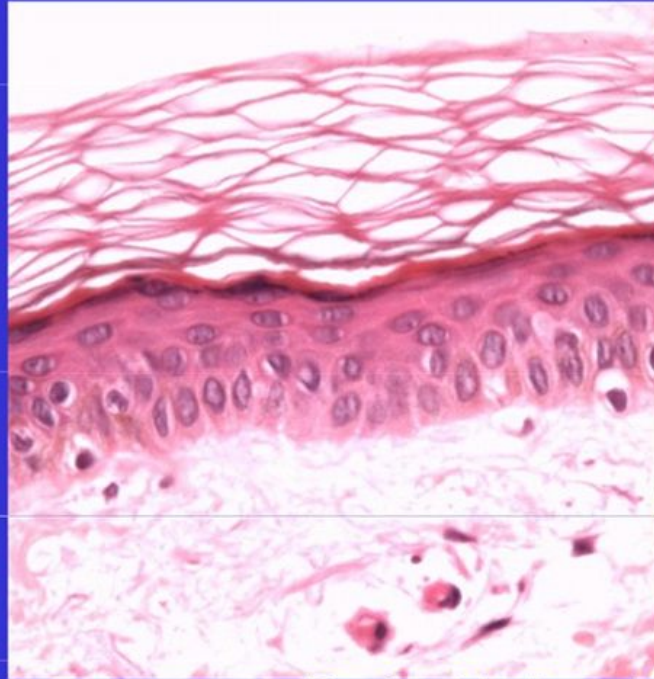
Sulfur-containing pheomelanin (yellow to reddish-brown)

The type and amount of melanin and its distribution pattern in the surrounding keratinocytes determine the actual color of the skin and provide the basis of the 3 principal; skin colors: black, brown and white

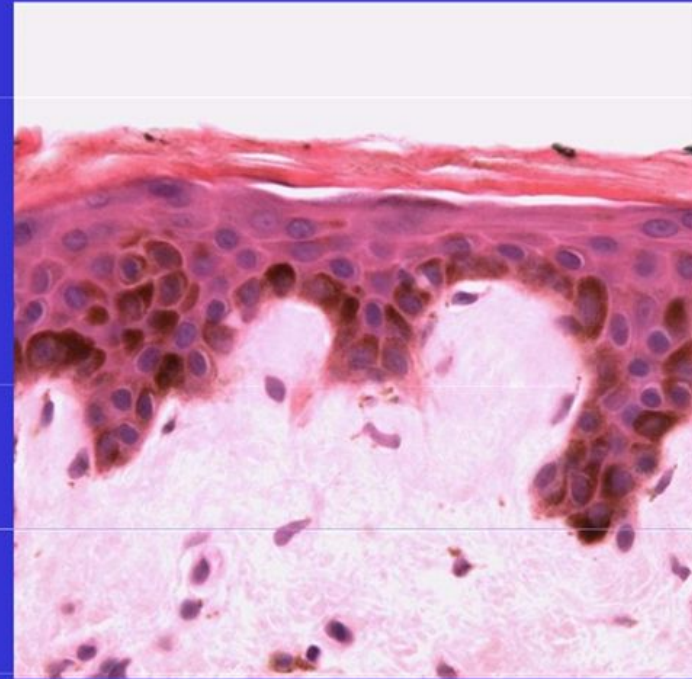
Everett, Budescu, Sommers et al., 2012



Light skin



Dark skin



Dark skin has increased production of melanosomes, and melanin
More transfer of melanin to keratinocytes
Slower rate of degradation of melanosomes

Skin Color

- Constitutive- persons baseline (without ultraviolet exposure). Example: unexposed/untanned areas such as upper inner arms.
- Facultative – skin color with increased melanin production which alters the skin from baseline after exposure to sun or ultraviolet sources. Represents most skin types. Example: exposed/tanned such as the forearm (Choe et al., 2006).

Why Skin Color?

- An important variable when studying wound healing (color changes of burn injuries (de Chalain, Tang, & Thomson, 1998), and venous ulcer wound healing (Romanelli, 1997) and pressure ulcer/injury risk assessment in persons with lighter skin tones
- Not an reliable indicator of pressure ulcer/injury risk or a reliable indicator of skin or tissue damage persons with darker skin tones
- Sexual Assault / Forensic – are we using the wrong instruments to detect tissue damage in darker skin color? (Sommers et al., 2012)

Characterizing Skin Pigmentation or Skin Tone Variation

- The von Luschan chromatic scale published in 1897; used extensively first half of 20th century in race studies and anthropometry. However, results inconsistent. In many instances, different investigators would give different readings of same person. This scale was largely abandoned by early 1950s, replaced with methods utilizing reflectance spectrophotometry.
- The Fitzpatrick scale (1975) of different skin types and colors was developed as a way to estimate the response of different types of skin to ultraviolet (UV) light.

	1	10			19	28	
	2	11			20	29	
	3	12			21	30	
	4	13			22	31	
	5	14			23	32	
	6	15			24	33	
	7	16			25	34	
	8	17			26	35	
	9	18			27	36	

Fitzpatrick skin pigmentation classification scale

Skin type is determined by several factors, including genetics, as indicated by skin color and reaction to sun exposure. The scale below classifies skin by complexion and tolerance of sunlight. Many practitioners use it to determine how likely a patient is to get skin cancer.

SKIN TYPE	APPEARANCE	REACTION TO SUN EXPOSURE
Type I	<ul style="list-style-type: none"> Very fair; very light ivory skin tone Freckles common Usually blond hair and light-colored eyes 	Always burns; never tans
Type II	<ul style="list-style-type: none"> Fair Light white to pale tan skin tone Light eyes and hair 	Burns easily; tans minimally
Type III	<ul style="list-style-type: none"> Fair to medium tan skin tone Eye and hair color vary 	Burns moderately; tans moderately
Type IV	<ul style="list-style-type: none"> Medium, beige-olive skin tone Moderate pigmentation Usually dark hair and eyes 	Burns minimally; tans easily
Type V	<ul style="list-style-type: none"> Medium brown skin tone Heavy pigmentation. Usually dark hair and eyes. 	Rarely burns; tans profusely
Type VI	<ul style="list-style-type: none"> Dark brown to black skin tone Heavy pigmentation Dark hair and eyes 	Never burns*; tans profusely

Based on: Fitzpatrick T. The validity and practicality of sun-reactive skin types I through VI. *Arch Dermatol.* 1988;124:869-871.

Eye colour

- 0. Light colours
- 1. Blue, gray or green
- 2. Dark
- 3. Brown
- 4. Black

Natural hair colour

- 0. Sandy red
- 1. Blond
- 2. Chestnut or dark blond
- 3. Brown
- 4. Black

Your skin colour (unexposed areas)

- 0. Reddish
- 1. Pale
- 2. Beige or olive
- 3. Brown
- 4. Dark brown

Freckles (unexposed areas)

- 0. Many
- 1. Several
- 2. Few
- 3. Rare
- 4. None

If you stay in the sun too long?

- 0. Painful blisters, peeling
- 1. Mild blisters, peeling
- 2. Burn, mild peeling
- 3. Rare
- 4. No burning

Do you turn brown?

- 0. Never
- 1. Seldom
- 2. Sometimes
- 3. Often
- 4. Always

How brown do you get?

- 0. Never
- 1. Light tan
- 2. Medium tan
- 3. Dark tan
- 4. Deep dark

Is your face sensitive to the sun?

- 0. Very sensitive
- 1. Sensitive
- 2. Sometimes
- 3. Resistant
- 4. Never have a problem

How often do you tan?

- 0. Never
- 1. Seldom
- 2. Sometimes
- 3. Often
- 4. Always

When was your last tan?

- 0. +3 months ago
- 1. 2-3 months ago
- 2. 1-2 months ago
- 3. Weeks ago
- 4. Days

Score

0-6 **Skin Type I**

Always burns, never tans (pale white skin)



7-13 **Skin Type II**

Always burns easily, tans minimally (white skin)



14-20 **Skin Type III**

Burns moderately, tans uniformly (light brown skin)



21-27 **Skin Type IV**

Burns minimally, always tans well (moderate brown skin)



28-34 **Skin Type V**

Rarely burns, tans profusely (dark brown skin)



35+ **Skin Type VI**

Never burns (deeply pigmented dark brown to black skin)



Munsell Color Theory

- Munsell color: visually identify and match color using a scientific approach based on a three-dimensional model depicted in the Munsell color tree (Munsell, 1929). Each color has three qualities or attributes: Hue, value, and chroma (HVC)
- Hue – What is the color attribute? Is it red, orange, yellow, blue etc.
- Value – How light or dark is the color? How much toward black or white? On a 0 to 10 scale. Lower numbers indicate darker color.
- Chroma – Is weak or strong is the color? Is color bright or vibrant? Intensity of the color indicated with numbers. Look for the saturation or brilliance of the color from weak (from the left) to strong (to the right), in ascending order. Lower numbers indicate weaker chroma.

(Munsell, 2018)

Fitzpatrick vs Munsell

Fitzpatrick

- Used in dermatology to classify skin type based on ones' sensitivity to ultraviolet rays (Fitzpatrick, 1998).
- Validity questionable since was developed and used primarily for persons of European ethnicity (Pinchon et al., 2010).
- Uses 'tan' and 'burn' terms, which reflects viewpoint toward experience of Caucasian/Europeans' experience to sun reactivity (McCreath et al., 2016).

Munsell

- Provides more objective assessment of skin tone/color.
- Used to describe human skin tone specifically related to dermatology and skin tone in dark and light toned skin (Gitelson 1965, Lim & Tham 1997, Reisfeld 2000, Riordan *et al.* 2001, Sivarajan & Mackay 2005).
- Provides objective measure of skin tone for early and aggressive prevention and increasing sensitivity of PU risk assessment for clinical practice and research (McCreath et al., 2016; Bates, McCreath & Patlan, 2017).

Problem with Visual Inspection

- Reliability and validity of visual skin assessment alone varies greatly, with overall figures suggesting only moderate agreement among assessors (Oliveira, Moore, O'Connor, & Patton, 2017).

Reflectance Spectroscopy

- In use more than 50 years, determine color by measuring the intensity of reflected light of specific wavelengths
- Tristimulus colorimetry-objectively represent color that is analogous to the human eye. Measure intensity of the reflected through 3 particular wavelengths filters.
- Results expressed (CIE) lab system: (L^*) lightness value, amount of green or red (a^*) and the amount of yellow or blue (b^*)
- In practice the L^* value expresses the relative brightness of color (ranging from black to white) b^* value measures pigmentation, a^* best captures erythema or skin redness.
- Most widely used in Chromameter



Darker skin tones and pressure

- Most pressure ulcer staging system definitions emphasize intact skin redness to indicate early pressure damage
- Since 1997, the NPUAP task force on “Stage I Definition and Darkly Pigmented Skin” chose to include more than color
- With lack of pressure injury early warning visual cues in darker skinned individuals, it becomes critical to define other ways of identifying early pressure-related damage in persons with darker skin tones

Darker Skin and Pressure Ulcers

JoAnn Maklebust (2005). Pressure Ulcers: The Great Insult. *Nurs Clin N Am*, 40: 365-389.

- Skin color is influenced by presence of skin pigments such as melanin or hemosiderin, making it difficult to identify pressure-related changes in patients with darkly pigmented skin.
- Dark skin does not exhibit characteristic erythematous changes normally associated with pressure damage in lightly pigmented skin...damaged areas of skin tend to look darker than surrounding skin and often are indurated, edematous, taut, and shiny.
- Color changes in dark skin can range from purplish to blue, comparable with a red to reddish-blue color associated with erythema in lighter skin tones.
- High melanin concentration in dark skin prevents observation of blanch response to light finger pressure...if compressed, color of pressure-related damage does not pale or blanch (as it does in lighter skin).
- Matas et al. studied ability of visible and near infrared spectroscopy to monitor blanch response in light and dark skin, based on changes in blood volume. Light and dark-skinned groups differed in pigmentation in both visible and near infrared regions of the spectrum.

Pressure Ulcer/Injury Prevention for Everyone

- Risk assessment & Documentation
- Skin assessment & Documentation
- Staging & Documentation
- PU/PI monitoring & Documentation

Pressure Ulcer / Injury Prevention

- International guidelines (NPUAP, EPUAP, PPPIA, 2014) recommend conducting comprehensive skin inspection as soon as possible, but within 8 hours of admission or first visit in community settings.
- However, physiologically a pressure ulcer can develop as early as within 1 hour (Gefen, 2008 and 2009) in those at risk.
- After initial skin assessment, inspection and monitoring by trained staff are recommended at least daily as part of every risk assessment when patients are deemed at risk for pressure ulcers or have existing impaired skin integrity (Bryant & Nix, 2016).
- Skin assessment frequency should be increased if patient's overall condition deteriorates

Objective	Prevention Interventions in General (Actions)
Identify risk	Use validated risk assessment tool for setting & population; psychosocial and environmental assessment; history and physical; comorbid conditions; patient/caregiver education
Monitor skin	Inspect all skin and areas of device contact regularly/ at least daily and if any change in condition; patient/caregiver education
Manage moisture	Manage wetness & incontinence; maintain skin hygiene & moisturizers; appropriate use of skin barrier products
Optimize nutrition	Nutritional consult; closely monitor nutritional and hydration status. Ensure adequate nutrient & fluid intake consistent with medical condition; patient/caregiver education
Optimize mobility	Rehabilitation program, range of motion, early ambulation if medically feasible; appropriate use of SPHM equipment (overhead lifts, air transfer devices, etc.); patient/caregiver education
Off-load pressure	Pressure redistribution devices for bed, chair, transport & procedural surfaces consistent with risk; Individualized plan and schedule for re-positioning; float heels; patient/caregiver education
Manage shear & friction	Appropriate use of SPHM transfer devices & techniques; limit HOB elevation when medically feasible; patient/caregiver education
Manage comorbidities	Interdisciplinary collaboration; appropriate consults/referrals: e.g.: Off-loading equipment specialist; OT/PT referral; RD referral; Incontinence specialist, etc.; patient/caregiver education

Risk Assessment Documentation

(Example Audit Questions)

- Validated risk assessment tool utilized
- Documented care plan linked risk assessment findings to specific preventive interventions
- Patients with impaired sensory perception, mobility, and activity as defined by risk assessment scale (RAS) had following applicable interventions documented:
Repositioning every 2 hours, Heels elevated off bed, Appropriate support surfaces (mattresses, chair cushions) for pressure redistribution
- Patients with friction/shear risk as defined by RAS (such as Braden scale) had head of bed elevated ≤ 30 degrees documented (if medically contraindicated, physician's order and alternative plan to prevent shear injury were documented)

- Patients with nutritional deficits as defined by RAS/Nutritional Assessment/Braden scale were followed by dietary services once the deficit was identified
- Patients with incontinence have documentation that perineal cleanser and barrier were used and underlying cause addressed
- Patient/family skin safety education and patient response were documented
- Standard skin safety interventions that were determined to be medically contraindicated or inconsistent with the patient's overall goals were documented or ordered by a physician and re-evaluated routinely
- Inability to adhere to standard skin safety interventions (i.e., noncompliance) was documented with evidence of patient/family education and ongoing efforts to reeducate or modify care plan

Skin Assessment Documentation (Sample Audit Questions)

- Skin inspection was documented on admission and daily
- Removal of devices, such as stockings and splints, for skin inspection at least twice a day was documented
- Devices that cannot be removed, such as indwelling tubes and drains, are stabilized and repositioned for daily skin inspection

Special Considerations for Darker Skin

- Rarely shows blanch response to light touch
- Check for localized changes in skin temperature: Palpate clean, intact skin over bony prominences with non-gloved hand to detect subtle changes in temperature from surrounding skin (cooler or warmer)
- Check for localized changes in skin texture: taut, shiny, hardened/indurated, boggy
- A light from a flashlight (non UV light source) may help enhance visualization of slight skin tone changes over bony prominences – note: irritation may cause hyperpigmentation or hypopigmentation with no visible redness
- Sometimes, darker skin tones take on a dark bluish purple tint at site of early PU/I development

Assessment Skills for Darker Skin

- Use a skin tone or pigment scale to assess any differences in persons with darker skin color
- Train staff to assess skin health through direct skin assessment (both visual and palpation) of high risk areas such as sacrum, heels, buttocks and ischium
- Assess skin areas after ointments, skin creams, feces or urine have been gently cleansed/removed. Assess skin areas surrounding scar tissue
- Early damage to darker skin tones may be transient and difficult to detect

Assessment Skills for Darker Skin Tones

Assess skin health for the following (McCreath et al., 2016)

- Erythema **and** skin discoloration
 - Present or absent
- Rate Coloration Severity (quantify color changes)
 - Minimal (pink in light skin tones; slight deepening in dark skin tones).
 - Moderate (bright red in light skin tones; purple in dark skin tones)
 - Severe (dark red to purple in light skin tones; and black-blue in dark skin tones)

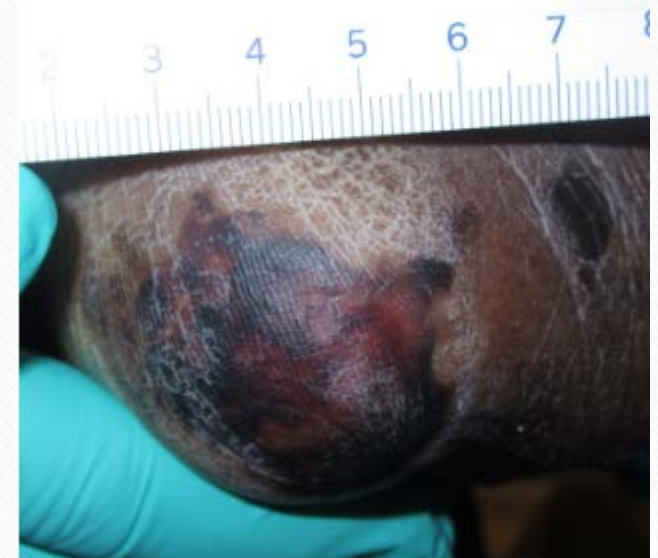
Assessment Skills

If you do note erythema:

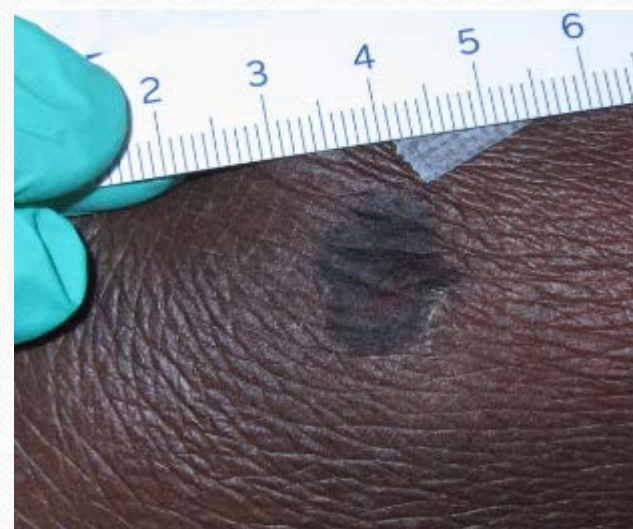
- Presence of erythema determined after light palpation to area to elicit blanch response.
- Moderate skin discoloration for all skin tones additionally with blanching for light skin tones.
- **Just because erythema is not observable in darker skin tones, doesn't mean damage is absent**

Hidden Assessment Findings

- Assessment of dry/ashy skin (may be unable to assess underlying tissue for DTI)
- PU/PI risk assessment performed and interventions implemented
- Skin cleansed and moisturizer applied (hydrate the skin)
- Skin is re-assessed for discoloration



Stage 1 PI and DTI



Assessment Tools

Needed: Methods or a device that can provide objective measures and identify early skin damage before it is visible to the naked eye in all skin tones

- SEM (sub-epidermal moisture) detector: a device used to detect and measure interstitial moisture below the stratum corneum. Use in conjunction with skin assessment/skin health. (Bates-Jensen, McCreath & Patlan, 2017)
- Ultrasound – able to detect pockets of fluid/edema at different sites of skin comparable with early tissue damage. (Oliveira, Moore, O'Connor, & Patton, 2017).
- Infrared Thermography: Objective measure of skin temperature changes over bony prominences indicative of early pressure related changes.
(<https://www.woundsresearch.com/article/evidence-corner-thermal-images-enhance-pressure-ulcer-risk-detection>)

Case Study

- 72 year old Haitian male admitted for diabetic crisis (blood sugar on admission 568). Diabetes type II for over 20 years, normally controlled by Metformin and sliding scale insulin. Wife died 1 year ago. Lives alone. No close family. Ran out of medication and couldn't afford refills. Pedal pulses only palpable by doppler. Ankle Brachial Index (ABI) 0.5 R and 0.7 on Left. BMI 18 (30 lb weight loss in past 6 months). HGB A1C 8.4.
- What else do you want to know?
- What PU/PI risk factors can you identify so far?

Potential Interventions

- What PU/PI prevention measures will you put into place for this man?

Follow Up

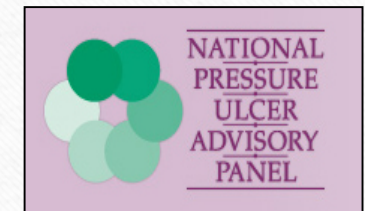
- What kind of follow-up would be important for this man?

Prevention Guidelines



Agency for Healthcare Research and Quality
Advancing Excellence in Health Care

Source	Guideline Link
CMS	https://partnershipforpatients.cms.gov/p4p_resources/tsp-pressureulcers/toolpressureulcers.html
EPUAP NPUAP	http://internationalguideline.com/ http://www.npuap.org/
AHRQ	https://www.ahrq.gov/professionals/systems/hospital/pressureulcertoolkit/index.html
WOCN	https://www.wocn.org/news/303467/Guideline-for-Prevention-and-Management-of-Pressure-Ulcers-Injuries---Now-Available.htm
AAWC	https://s3.amazonaws.com/aawc-new/memberclicks/AAWCPU-Qwik-Ref-Final-23Sep11.pdf



Additional Resources

Cochrane Database of Systematic Reviews: **Repositioning for pressure ulcer prevention in adults.**

Cochrane Systematic Review - Intervention, Version published: 03 April 2014:

<https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD009958.pub2/full>

Research Gaps

Time to assess individuals **individually**

- Research on pressure ulcer/injury development is extensive yet has not fully addressed skin tone differences
- Historically, “investigators have stratified skin color based on socially constructed racial or ethnic lines with the untested hypothesis that “Black” populations have “dark” skin, European populations have “light” skin, and biracial, Asian, and Hispanic/Latino populations have mid-range skin tones” (Abbade, Lastoria, & de Almeida Rollo, 2011; Fitzpatrick, 1988; Pinchon et al., 2010; McCreath et al., 2016)
- Current scientific literature is just beginning to address research gaps related to skin tone variance in skin assessments, acknowledging skin tone ethnicity cannot be used as a proxy for skin tone (Everett & Sommers 2012; McCreath et al., 2016; Pichon et. al., 2010)
- Need for researchers to acknowledge skin tone variance when further developing PU/I assessment and risk management strategies and identify evidence-based methods/instruments to best assess pigmentation differences

Questions / Comments?



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