Representation of dark skin images of common dermatologic conditions in educational resources: A cross-sectional analysis

To the Editor: Cutaneous pathology appears significantly different on disparate skin tones. Access to educational materials illustrating pathology across all skin tones plays a crucial role in developing pattern recognition skills and improving diagnostic confidence.[1,2] Given the increasingly diverse patient population and known dermatologic health disparities,[3] we aimed to assess the prevalence of dark skin images in widely used contemporary print and web-based dermatology resources.

Eight commonly used resources (6 textbooks and 2 web-based resources) and 65 conditions were selected for review. For each condition, images were categorized as light skin images, dark skin images (DSIs) (Fitzpatrick phototypes V or VI), or indeterminate (because of extent of disease involvement, image frame, or lighting).

Of the 15,445 images across all resources, 19.5% were DSIs. Online resources had a greater representation of DSIs (22.1%) compared to printed texts (10.3%) (Table I). For online resources, VisualDx had a greater representation of DSIs (28.5%) compared to DermNet NZ (2.8%). DSI representation varied based on dermatologic conditions. Disorders of Langerhans cells and macrophages had the greatest representation of DSIs (36.8%), whereas neoplasms of the skin (10.6%) and adnexal diseases (12.3%) had the lowest (Table II). These discrepancies are not consistently reflective of the incidence and prevalence in the population; overall, there is disproportionately lower representation when comparing the proportion of DSIs to epidemiologic data. However, the high representation of DSIs in conditions such as sarcoidosis and syphilis may be reflective of a disproportionate incidence in dark-skinned individuals.

This analysis underscores variations in DSI representation among learning resources and dermatologic conditions. The lower representation of DSIs in textbooks may relate to the limited space, need to show classic cases, and reuse of images. Online resources have more flexibility to add images to their database, allowing for a more comprehensive illustration of pathology. Accordingly, VisualDx shows pathology on dark skin in a remarkably high proportion compared to other resources.

Our data show an exceedingly low representation of DSIs in neoplasms of the skin, which is consistent with prior studies.[10] Although the incidence of most skin cancers is lower in individuals with dark skin, these patients often have worse clinical outcomes, including disproportionately higher morbidity and mortality.[3,11] Consequently, rather than reflecting the incidence of disease in the patient population,

Table I. Extent of illustration of dark skin in commonly used dermatologic learning resources for the 65 common dermatologic conditions included in this study

Learning resources	Total, n	Light, n	Dark, n	Indeterminate, n	Dark, %
Printed texts	3469	3067	356	46	10.3
Dermatology, 4th edition Bolognia[4]	748	634	99	15	13.2
Andrews' Diseases of the Skin, 13th edition James[5]	372	295	74	3	19.9
Fitzpatrick's Dermatology, 9th edition Kang[6]	516	428	78	10	15.1
Rook's Textbook of Dermatology, 8th edition Burns[7]	544	493	40	11	7.4
Clinical Dermatology: A Color Guide to Diagnosis and Therapy, 6th edition Habif[8]	863	822	39	2	4.5
Fitzpatrick's Color Atlas and Synopsis of Clinical Dermatology, 8th edition Wolff[9]	426	395	26	5	6.1
Online resources	11,976	9269	2652	55	22.1
VisualDx	9007	6417	2569	21	28.5
DermNet NZ	2969	2852	83	34	2.8
Total	15,445	12,336	3008	101	19.5

Table II. Extent of illustration of dark skin in common dermatologic conditions across all dermatologic learning resources (printed texts and online resources) and available incidence and prevalence epidemiologic data for these dermatologic conditions

Dermatologic conditions and diagnoses	Total images, n	Dark skin images, n	Dark skin images, %	Disease incidence/prevalence for general population	Disease incidence/prevalence by race/ethnicity
Disorders of Langerhans cells and macrophages	473	174	36.8		
Sarcoidosis	201	116	57.7	7.6-8.8 per 100,000 incidence (general population)	17.8-46 per 100,000 incidence (African American)
Xanthoma	195	52	26.7	1%-4% prevalence (general population)	No reliable figures available
Necrobiosis lipoidica	77	6	7.8	0.3%-1.2% prevalence (general population with diabetes)	No reliable figures available
Infections, infestations, and bites	4095	1010	24.7		
Syphilis	436	259	59.4	3-18.7 per 100,000 incidence (general population)	8.4-28.1 per 100,000 incidence (African American)
Pityriasis versicolor	166	55	33.1	1.1% prevalence (general population in Sweden)	No determined difference based on ethnicity
Tinea	526	153	29.1	21.3 per 100,000 prevalence (general population)	17.8 per 100,000 prevalence (African American)
Varicella	198	56	28.3	4.1 per 100,000 incidence (general population)	7.8 per 100,000 incidence (African American)
Herpes zoster	261	70	26.8	12.4% prevalence (general population aged 60+ years)	8% prevalence (African American)
Molluscum	222	53	23.9	<5% prevalence (general pediatric population); 33% prevalence (patients with HIV)	2-4 odds ratio of prevalence (not white compared to white)
Impetigo	242	57	23.6	1080-2220 per 100,000 incidence (general pediatric population)	No reliable figures available
Warts	404	95	23.5	37.3% incidence (general male population)	45.7% incidence (African American male patients)
Scabies	310	62	20	221-281 per 100,000 prevalence (general population)	No determined difference based on ethnicity
Insect bite	167	26	15.6	No reliable figures available	No determined difference based on ethnicity
Measles	111	16	14.4	0.02-0.04 per 100,000 incidence (general population)	0.04 per 100,000 incidence (minority populations)
Candidiasis	246	35	14.2	No reliable figures available	No determined difference based on ethnicity
Herpes simplex	362	50	13.8	47.8% prevalence (HSV1); 11.9% prevalence (HSV2) (general population)	58.5% prevalence (HSV1); 34.6% prevalence (HSV2) (African American)
Cellulitis	113	15	13.3	200.3 per 100,000 incidence (general population)	200.6 per 100,000 incidence (African American)
Erysipelas	77	5	6.5	249 per 100,000 incidence (general population)	No determined difference based on ethnicity
Erythema infectiosum	55	1	1.8	90% prevalence of seropositivity (general population aged 60+ years)	No determined difference based on ethnicity

Continued

Table II. Cont'd

Dermatologic conditions and diagnoses	Total images, n	Dark skin images, n	Dark skin images, %	Disease incidence/prevalence for general population	Disease incidence/prevalence by race/ethnicity
Erythema migrans	122	2	1.6	27.0 per 100,000 incidence (general population)	4.8 per 100,000 incidence (African American)
Rubella	46	0	0	<0.01 per 100,000 incidence (general population)	9% of cases were in African American patients
Roseola	31	0	0	77% prevalence of seropositivity (general population aged 24 months)	No determined difference based on ethnicity
Rheumatologic and systemic dermatologic diseases	1996	488	24.4		
Vitiligo	288	109	37.8	0.2 per 100,000 prevalence (general population)	No reliable figures available
Scleroderma/morphea	319	101	31.7	24.2 per 100,000 prevalence (general population)	31.5 per 100,000 prevalence (African American)
Alopecia	176	53	30.1	2.1% lifetime incidence (general population)	1.77 odds ratio of incidence (African American compared to white)
Cutaneous lupus erythematosus	450	114	25.3	4.2 per 100,000 incidence (general population)	119 per 100,000 incidence (African American)
Systemic lupus erythematosus	220	47	21.4	2.9 per 100,000 incidence (general population)	7.2 per 100,000 incidence (African American)
Granuloma annulare	221	43	19.5	0.1%-0.4% prevalence (general population seeking dermatology consultations)	No determined difference based on ethnicity
Lichen sclerosis et atrophicus	232	19	8.2	100-330 per 100,000 incidence (general population of US Armed Forces)	1.4 per 100,000 prevalence (dermatology consultations of African American patients)
Erythema nodosum	90	2	2.2	0.38%-0.5% prevalence (general population)	No reliable figures available
Papulosquamous and eczematous dermatoses	2845	596	20.9		
Lichen simplex chronicus	100	48	48	4.04%-12% prevalence (general population)	No determined difference based on ethnicity
Pityriasis rosea	189	81	42.9	172.2 per 100,000 incidence (general population)	2 odds ratio of incidence (African American individuals compared to the rest of the population)
Erythroderma	141	46	32.6	0.9-2 per 100,000 prevalence (general population)	No reliable figures available
Ichthyosis	220	60	27.3	0.5 per 100,000 prevalence (general population)	No reliable figures available
Seborrheic dermatitis	139	37	26.6	1%-11.6% prevalence (general population)	0.36-0.39 odds ratio of prevalence (light brown and black skin compared to white skin)
Lichen planus	359	85	23.7	1.27% prevalence (general population)	No reliable figures available
Psoriasis	518	99	19.1	3.2% prevalence (general adult population)	1.9% prevalence (African American)
Stasis dermatitis	131	20	15.3	6%-7% prevalence (general population aged 50+ years)	No determined difference based on ethnicity

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Table II. Cont'd

Dermatologic conditions and diagnoses	Total images, n	Dark skin images, n	Dark skin images, %	Disease incidence/prevalence for general population	Disease incidence/prevalence by race/ethnicity
Atopic dermatitis	151	20	13.2	0.2%-24.6% prevalence (general population)	1.7 odds ratio of prevalence (African American compared to European American individuals)
Erythema annulare centrifugum	111	13	11.7	1 per 100,000 incidence (general population)	No reliable figures available
Contact dermatitis	756	85	11.2	20% prevalence (general population)	No determined difference based on ethnicity
Cheilitis	37	2	5.4	0.7% prevalence (general population)	17% incidence (individuals with dark skin tones)
Urticarias, erythemas, purpuras, and vascular disorders	1218	192	15.8		
Erythema multiforme	262	63	24	0.01%-1% incidence (general population)	No reliable figures available
Drug eruptions	422	66	15.6	180-700 per 100,000 prevalence (general population of hospitalized patients)	No reliable figures available
Vasculitis	211	31	14.7	200 per 100,000 incidence (general population)	No reliable figures available
Infantile hemangioma	167	17	10.2	4.5% incidence (general population)	3.5% incidence (African American)
Urticaria	156	15	9.6	0.23% prevalence (general population)	0.29% prevalence (African American)
Vesicobullous diseases	369	56	15.2		
Bullous pemphigoid	153	30	19.6	12 per 100,000 prevalence (general population)	15.4 per 100,000 prevalence (African Americans)
Dermatitis herpetiformis	74	12	16.2	10-11.2 per 100,000 prevalence (general population)	No reliable figures available
Pemphigus vulgaris	142	14	9.9	0.42-0.68 per 100,000 prevalence (general population)	No reliable figures available
Adnexal diseases	1180	145	12.3		
Keratosis pilaris	95	24	25.3	40%-80% prevalence (general population)	No determined difference based on ethnicity
Miliaria	115	26	22.6	30% incidence (general population)	No reliable figures available
Acne vulgaris	569	64	11.2	14.3%-24% prevalence (general population)	37% prevalence (African American women)
Folliculitis	220	21	9.5	No reliable figures available	No reliable figures available
Rosacea	181	10	5.5	5.496% prevalence (general population of dermatology patients)	10% prevalence (skin of color)
Neoplasms of the skin	3269	347	10.6		
Neurofibroma	119	48	40.3	33.3 per 100,000 prevalence (general population)	No determined difference based on ethnicity
Cutaneous T-cell lymphoma	300	108	36	1.07 per 100,000 incidence (general population)	1.15 per 100,000 incidence (African American)
Kaposi sarcoma	201	47	23.4	0.6 per 100,000 incidence (general population)	2.96 per 100,000 incidence (African American)
Seborrheic keratosis	203	20	9.9	90% prevalence (general population aged 60+ years)	No reliable figures available

Continued

Table II. Cont'd

Dermatologic conditions and diagnoses	Total images, n	Dark skin images, n	Dark skin images, %	Disease incidence/prevalence for general population	Disease incidence/prevalence by race/ethnicity
Squamous cell carcinoma/ keratoacanthoma	363	32	8.8	296-497 per 100,000 incidence (general population)	3 per 100,000 incidence (African American)
Benign melanocytic nevus	791	58	7.3	95% prevalence (general population)	0.12 odds ratio of incidence (Fitzpatrick V versus I and II)
Dermatofibroma	17	1	5.9	No reliable figures available	No reliable figures available
Melanoma	620	24	3.9	22 per 100,000 incidence (general population)	0.9 per 100,000 incidence (African American)
Basal cell carcinoma	381	9	2.4	226-353 per 100,000 incidence (general population)	0.06 odds ratio of prevalence (African American compared to white)
Actinic keratosis	274	0	0	11%-26% incidence (general population)	No reliable figures available
Total	15,445	3008	20.1		

HSV, Herpes simplex virus.

educational materials must comprehensively illustrate all pathology in patients of a spectrum of skin tones. This includes presentations that trainees may be unlikely to encounter through the course of their clinical training. Images should be supplemented with clinical pearls for conditions harder to diagnose in darker skin tones, although this should not replace high-quality photographs.

This study is limited by the inherent subjective nature of designating skin tone, the omission of individuals of racial/ethnic minorities with lighter skin tone, and the inability to directly link DSI representation and patient outcomes. Increased effort and guidance pertaining specifically to photographing skin of color are needed, given the challenges of photographing pathology on dark skin. With the gap in availability of DSIs in dermatology educational materials, online resources may play a role in providing more exposure to pathology on dark skin.

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REFERENCES

1. Rimoin L, Altieri L, Craft N, Krasne S, Kellman PJ. Training pattern recognition of skin lesion morphology, configuration, and distribution. *J Am Acad Dermatol*. 2015;72(3):489-495.
2. Fourniquet E, Garvie K, Beiter K. Exposure to dermatological pathology on skin of color increases physician and student confidence in diagnosing pathology in patients of color. *FASEB J*. 2019;33(S1):606.18.
3. Buster KJ, Stevens EI, Elmets CA. Dermatologic health disparities. *Dermatol Clin*. 2012;30(1):53-59.
4. Bolognia J, Schaffer J, Cerroni L. Dermatology (4th ed.). Amsterdam, The Netherlands: Elsevier; 2018.
5. James W, Elston D, Treat J, Rosenbach M, Neuhaus I. Andrews' diseases of the skin (13th ed.). Amsterdam, The Netherlands: Elsevier; 2019.
6. Kang S. (2019). *Fitzpatrick's Dermatology, Ninth Edition, 2-Volume Set (Fitzpatricks Dermatology in General Medicine)* (9th ed.). New York: McGraw-Hill Education/Medical.
7. Burns T, Breathnach S, Cox N, & Griffiths C. (2010). *Rook's Textbook of Dermatology* (8th ed.). Hoboken: Wiley-Blackwell.
8. Habif TP. (2015). *Clinical Dermatology E-Book: A Color Guide to Diagnosis and Therapy* (6th ed.). Mosby.
9. Wolff K, Johnson AR, Saavedra A, & Roh E. (2017). *Fitzpatrick's Color Atlas and Synopsis of Clinical Dermatology* (8th ed.). New York: McGraw-Hill Education/Medical.
10. Louie P, Wilkes R. Representations of race and skin tone in medical textbook imagery. *Soc Sci Med*. 2018;202:38-42.
11. Davis SA, Narahari S, Feldman SR, Huang W, Pichardo-Geisinger RO, McMichael AJ. Top dermatologic conditions in patients of color: an analysis of nationally representative data. *J Drugs Dermatol*. 2012;11(4):466-473.

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