

Improving Diagnostic Accuracy in Skin of Color Using an Educational Module

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PRACTICE POINTS

- Disparities exist among interprofessional health care providers when diagnosing conditions in patients with lighter and darker skin, specifically for infectious, cancerous, or inflammatory conditions vs conditions that are preferentially seen in patients with skin of color (SOC).
- A focused educational module for health care providers may provide long-term improvements in diagnostic accuracy and confidence for conditions presenting in patients with SOC.

Dermatologic disparities disproportionately affect patients with skin of color (SOC). This study evaluated the effectiveness of a focused educational module for improving diagnostic accuracy and confidence in the treatment of patients with SOC among interprofessional health care providers. An SOC educational module involving a pretest, 15-minute lecture, immediate posttest, and 3-month posttest was created. One hundred participants completed the pretest and immediate posttest; 36 of them also completed the 3-month posttest. Our results suggest that a focused educational module may provide long-term improvements in diagnostic accuracy and confidence for conditions presenting in patients with SOC.

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Dermatologic disparities disproportionately affect patients with skin of color (SOC). Two studies assessing the diagnostic accuracy of medical students have shown disparities in diagnosing common skin conditions presenting in darker skin compared to

lighter skin at early stages of training.^{1,2} This knowledge gap could be attributed to the underrepresentation of SOC in dermatologic textbooks, journals, and educational curricula.³⁻⁶ It is important for dermatologists as well as physicians in other specialties and ancillary health care workers involved in treating or triaging dermatologic diseases to recognize common skin conditions presenting in SOC. We sought to evaluate the effectiveness of a focused educational module for improving diagnostic accuracy and confidence in treating SOC among interprofessional health care providers.

Methods

Interprofessional health care providers—medical students, residents/fellows, attending physicians, advanced practice providers (APPs), and nurses practicing across various medical specialties—at The University of Texas at Austin Dell Medical School and Ascension Medical Group (both in Austin, Texas) were invited to participate in an institutional review board–exempt study involving a virtual SOC educational module from February through May 2021. The 1-hour module involved a pretest, a 15-minute lecture, an immediate posttest, and a 3-month posttest. All tests included the same 40 multiple-choice questions of 20 dermatologic conditions portrayed in lighter and darker skin types from VisualDx.com, and participants were asked to identify the condition in each photograph. Questions appeared one at a time in a randomized order, and answers could not be changed once submitted.

For analysis, the dermatologic conditions were categorized into 4 groups: cancerous, infectious, inflammatory, and SOC-associated conditions. Cancerous conditions

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included basal cell carcinoma, squamous cell carcinoma, and melanoma. Infectious conditions included herpes zoster, tinea corporis, tinea versicolor, staphylococcal scalded skin syndrome, and verruca vulgaris. Inflammatory conditions included acne, atopic dermatitis, pityriasis rosea, psoriasis, seborrheic dermatitis, contact dermatitis, lichen planus, and urticaria. Skin of color–associated conditions included hidradenitis suppurativa, acanthosis nigricans, keloid, and melasma. Two questions utilizing a 5-point Likert scale assessing confidence in diagnosing light and dark skin also were included.

The pre-recorded 15-minute video lecture was given by 2 dermatology residents (P.L.K. and C.P.), and the learning objectives covered morphologic differences in lighter skin and darker skin, comparisons of common dermatologic diseases in lighter skin and darker skin, diseases more commonly affecting patients with SOC, and treatment considerations for conditions affecting skin and hair in patients with SOC. Photographs from the diagnostic accuracy assessment were not reused in the lecture. Detailed explanations on morphology, diagnostic pearls, and treatment options for all conditions tested were provided to participants upon completion of the 3-month posttest.

Statistical Analysis—Test scores were compared between conditions shown in lighter and darker skin types and from the pretest to the immediate posttest and 3-month posttest. Multiple linear regression was used to assess for intervention effects on lighter and darker skin scores controlling for provider type and specialty. All tests were 2-sided with significance at $P < .05$. Analyses were conducted using Stata 17.

Results

One hundred participants completed the pretest and immediate posttest, 36 of whom also completed the 3-month posttest (Table). There was no significant difference in baseline characteristics between the pretest and 3-month posttest groups.

Test scores were correlated with provider type and specialty but not age, sex, or race/ethnicity. Specializing in dermatology and being a resident or attending physician were independently associated with higher test scores. Mean pretest diagnostic accuracy and confidence scores were higher for skin conditions shown in lighter skin compared with those shown in darker skin (13.6 vs 11.3 and 2.7 vs 1.9, respectively; both $P < .001$). Pretest diagnostic accuracy was significantly higher for skin conditions shown in lighter skin compared with darker skin for cancerous, inflammatory, and infectious conditions (72% vs 50%, 68% vs 55%, and 57% vs 47%, respectively; $P < .001$ for all) (Figure 1). Skin of color–associated conditions were not associated with significantly different scores for lighter skin compared with darker skin (79% vs 75%; $P = .059$).

Controlling for provider type and specialty, significantly improved diagnostic accuracy was seen in immediate posttest scores compared with pretest scores for conditions shown in both lighter and darker skin

types (lighter: 15.2 vs 13.6; darker: 13.3 vs 11.3; both $P < .001$) (Figure 2). The immediate posttest demonstrated higher mean diagnostic accuracy and confidence scores for skin conditions shown in lighter skin compared with darker skin (diagnostic accuracy: 15.2 vs 13.3; confidence: 3.0 vs 2.6; both $P < .001$), but the disparity between scores was less than in the pretest.

Following the 3-month posttest, improvement in diagnostic accuracy was noted among both lighter and darker skin types compared with the pretest, but the difference remained significant only for conditions shown in darker skin (mean scores, 11.3 vs 13.3; $P < .01$). Similarly, confidence in diagnosing conditions in both lighter and darker skin improved following the immediate posttest (mean scores, 2.7 vs 3.0 and 1.9 vs 2.6; both $P < .001$), and this improvement remained significant for only darker skin following the 3-month posttest (mean scores, 1.9 vs 2.3; $P < .001$). Despite these improvements, diagnostic accuracy and confidence remained higher for skin conditions shown in lighter skin compared with darker skin (diagnostic accuracy: 14.7 vs 13.3; $P < .01$; confidence: 2.8 vs 2.3; $P < .001$), though the disparity between scores was again less than in the pretest.

Comment

Our study showed that there are diagnostic disparities between lighter and darker skin types among interprofessional health care providers. Education on SOC should extend to interprofessional health care providers and other medical specialties involved in treating or triaging dermatologic diseases. A focused educational module may provide long-term improvements in diagnostic accuracy and confidence for conditions presenting in SOC. Differences in diagnostic accuracy between conditions shown in lighter and darker skin types were noted for the disease categories of infectious, cancerous, and inflammatory conditions, with the exception of conditions more frequently seen in patients with SOC. Learning resources for SOC-associated conditions are more likely to have greater representation of images depicting darker skin types.⁷ Future educational interventions may need to focus on dermatologic conditions that are not preferentially seen in patients with SOC. In our study, the pretest scores for conditions shown in darker skin were lowest among infectious and cancerous conditions. For infections, certain morphologic clues such as erythema are important for diagnosis but may be more subtle or difficult to discern in darker skin. It also is possible that providers may be less likely to suspect skin cancer in patients with SOC given that the morphologic presentation and/or anatomic site of involvement for skin cancers in SOC differs from those in lighter skin. Future educational interventions targeting disparities in diagnostic accuracy should focus on conditions that are not specifically associated with SOC.

Limitations of our study included the small number of participants, the study population came from a single institution, and a possible selection bias for providers interested in dermatology.

Participant Characteristics

Characteristic	Pretest, n (%) (N=100)	3-mo posttest, n (%) (N=36)
Specialty		
FM	16 (16.0)	4 (11.1)
IM	14 (14.0)	7 (19.4)
Dermatology	15 (15.0)	6 (16.7)
Pediatrics	19 (19.0)	11 (30.6)
EM	11 (11.0)	3 (8.3)
Other ^a	25 (25.0)	5 (13.9)
Type of provider		
APP	41 (41.0)	11 (30.6)
Medical student	10 (10.0)	0 (0)
Resident/fellow	26 (26.0)	15 (41.7)
Attending physician	18 (18.0)	9 (25.0)
Nurse	5 (5.0)	1 (2.8)
Sex		
Female	75 (75.0)	29 (80.6)
Male	25 (25.0)	7 (19.4)
Age group		
18–24 y	3 (3.0)	0 (0)
25–34 y	48 (48.0)	23 (63.9)
35–44 y	32 (32.0)	7 (19.4)
45–54 y	10 (10.0)	2 (5.6)
55–64 y	5 (5.0)	4 (11.1)
Prefer not to answer	2 (2.0)	0 (0)
Race/ethnicity		
White	66 (66.0)	22 (61.1)
Black	7 (7.0)	4 (11.1)
Latino	10 (10.0)	2 (5.6)
Asian	12 (12.0)	7 (19.4)
Other	5 (5.0)	1 (2.8)

Abbreviations: APP, advanced practice provider; EM, emergency medicine; FM, family medicine; IM, internal medicine.

^aOther specialties included cardiology, IM/pediatrics, intensive care, hematology/oncology, neurology, neurosurgery, obstetrics and gynecology, orthopedics, plastic surgery, and physical medicine and rehabilitation.

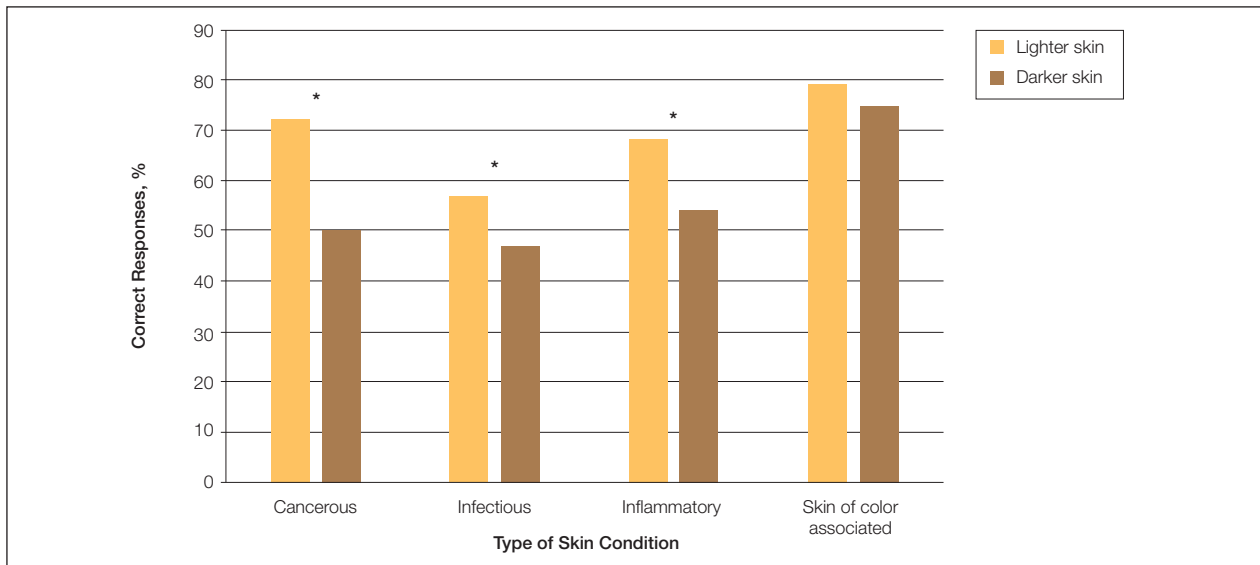


FIGURE 1. Pretest percentage correct score in lighter skin compared with darker skin categorized by type of skin condition. Asterisk indicates $P < .001$.

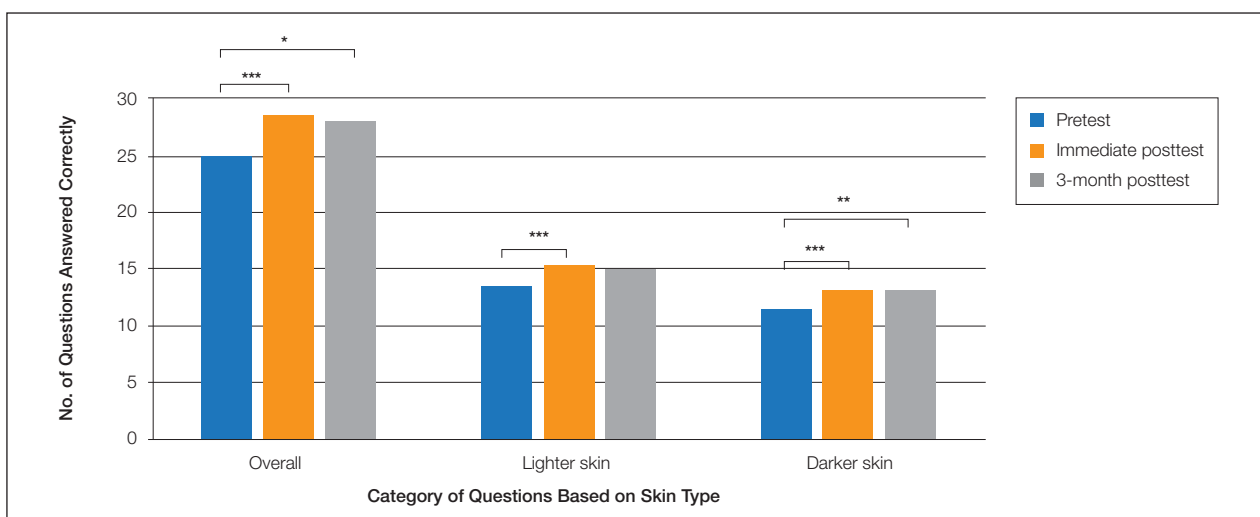


FIGURE 2. Mean scores for diagnostic accuracy overall and in lighter and darker skin following pretest, immediate posttest, and 3-month posttest. Single asterisk indicates $P < .05$; double asterisk, $P < .01$; triple asterisk, $P < .001$.

Conclusion

Disparities exist among interprofessional health care providers when treating conditions in patients with lighter skin compared to darker skin. An educational module for health care providers may provide long-term improvements in diagnostic accuracy and confidence for conditions presenting in patients with SOC.

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