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Color Bar Tool for Skin Type Self-Identification: a cross sectional study

Byron K. Ho, BA and June K. Robinson, MD

Department of Dermatology, Northwestern University Feinberg School of Medicine, 676 N. St Clair St, Chicago, IL, 60611, USA

The Fitzpatrick Skin Type (FST) has limited relevance and reliability among people with skin of color because individuals from a particular ethnic/racial group cluster into one Fitzpatrick category.¹ We developed a color tool to assess skin types.

The color bar tool was validated with two cohorts of 120 patients consisting of non-Hispanic Whites (NHW), Hispanics, non-Hispanic Blacks (NHB), and Asians with FST I to VI skin determined by the standard survey. From May to July 2014, a cross-sectional study compared survey responses: color bar tool, skin tone descriptions and the adapted Fitzpatrick skin type questions.² Participants' melanin index was obtained using spectrophotometry (Mexameter MX18 probe, Corage + Khazaka Electronic GmbH, Koln, Germany).

Sixty self-identified NHWs, 48 Hispanics, and 61 NHBs completed three surveys and had Mexameter readings (n=170). Median age was 50 years old. There were 101 men and 69 women among the respondents. Mean melanin index correlated linearly with the color bar response groups ($R^2 = 0.965$, $p < 0.0001$), skin tone descriptions ($R^2 = 0.867$, $p < 0.0001$), and Fitzpatrick sunburn propensity ($R^2 = 0.879$, $p < 0.04$). For the FST-tan/darker response data, a binomial fit performed best with R^2 of 0.963 compared to R^2 of 0.236 for a linear model ($p = 0.6$).

Corresponding Author: June K. Robinson, MD, Northwestern University Feinberg School of Medicine, 676 St Clair St, Suite 1260, Chicago, IL 60611, P: 312-926-7449, june-robinson@northwestern.edu, F: 312-695-9179.

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Among this ethnically heterogeneous population, people reliably self-selected color bars as assessed by melanin index. Responses to the color bars displayed the strongest linear relationship among the survey items with means evenly covering the range of melanin indices found in our study population.

While UVR-related skin cell damage correlates linearly with skin tone, UVR is linked to DNA damage across skin types.³ Race/ethnicity is a poor proxy for skin cancer risk because persons in racial/ethnic minority groups might have individual risk factors for skin cancer (e.g. lighter skin; or skin that sunburns easily). In our research, the colors bars allowed discrimination between the six groups and the colors correlated with melanin index, and with the individual's potential to have sunburn/skin irritation. Stern⁴ established that people with FST I, II had a greater skin cancer risk than those with III, IV. Since responses to the adapted FST discriminate among the six categories for all races/ethnicities, Stern's work can be extended to associating high skin cancer risk with FST I, II; medium risk with FST II, IV and low risk with FST V, VI.

As participants understood that survey items either explicitly or implicitly related to their skin color, cultural bias related to a preference for being either lighter or darker may have affected our results. These preferences among different ethnic groups, particularly Blacks, have been well-documented.⁵ Any attempt to categorize skin cancer risk by skin tone will need to be cognizant of possible shifting subconscious racial biases.

Our novel, easily-used color bar tool is economical and does not need a power source, calibration, or processing software, which are needed for spectrophotometry. This tool can be used with limited literacy adults and children, thus, populations can be screened for individuals with skin cancer risk and identify those needing sun protection.

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Figure.

Color bar survey item

The participant selected the color bar that most closely matched the skin tone on the inside part of their upper arm.

Table**Survey Responses and Mean Melanin Content**

	N (%)	Mean Melanin (95% CI)	ANOVA
Ethnicity			p < 0.0001
White	60 (36)	151 (141 – 161)	
Hispanic	48 (28)	228 (200 – 255)	
African American	61 (36)	533 (488 – 578)	
Color Bars			p < 0.0001
1	51 (38)	174 (144 – 204)	
2	39 (29)	230 (198 – 262)	
3	18 (14)	392 (301 – 483)	
4	13 (10)	528 (402 – 653)	
5	12 (9)	569 (457 – 682)	
6	0 (0)	No subjects	
Skin Tone			p < 0.0001
Very Fair 1	6 (3.5)	128 (89 – 167)	
Fair 2	63 (37)	191 (161 – 221)	
Olive or Golden 3	31 (18)	219 (183 – 255)	
Light Brown 4	49 (29)	397 (346 – 448)	
Dark Brown 5	20 (12)	669 (626 – 712)	
Very dark 6	1 (0.5)	563	
Skin of Color Adaptation of Fitzpatrick Sunburn/Skin Irritation			p < 0.0001
1: always burns, painful burn at 24 hrs	5 (3)	189 (25 – 353)	
2: easily burns, painful burn at 24 hrs	21 (12)	187 (152 – 222)	
3: Mild burning, skin irritation, tenderness, or itching in sun exposed skin	41 (24)	236 (187 – 285)	
4: Minimal skin irritation, tenderness, or itching in sun exposed skin,	52 (31)	282 (228 – 336)	
5: Occasional skin irritation, tenderness, or itching in sun exposed skin,	50 (30)	471 (410 – 531)	
6: No skin irritation, tenderness, or itching in sun exposed skin	None		
Skin of Color Adaptation of Fitzpatrick Tan/Darker			p < 0.0001
1: never develops a tan or gets darker in sun exposed skin	33 (20)	370 (293 – 447)	
2: develops a light tan or gets slightly darker in sun exposed skin	59 (35)	286 (231 – 341)	
3: develops a medium tan or skin or becomes slightly darker in sun exposed skin	40 (24)	242 (192 – 291)	
4: develops a deep tan or skin becomes darker in sun exposed skin	24 (14)	301 (216 – 387)	
5: develops darker skin in sun exposed skin	12 (7)	545 (443 – 647)	
6: no noticeable change in skin in sun exposed skin	None		