Sun-protective behaviors in patients with cutaneous hyperpigmentation: A cross-sectional study

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Background: Disorders of hyperpigmentation are seen commonly in clinical practice. Despite numerous studies investigating sun-protective habits among healthy persons, little is known about these behaviors within patient populations with hyperpigmentation disorders.

Objective: We sought to examine photo-protective behaviors and their associations in individuals with disorders of hyperpigmentation.

Methods: This cross-sectional study was conducted with 404 adults who complained of cutaneous hyperpigmentation.

Results: About 67.5% reported using a product containing sunscreen, and 91% endorsed using one with a sun protection factor of 21 or higher. Among the participants, 48.5% were not sure if their sunscreen provided broad-spectrum protection, and only 7.6% reapplied every 2 hours. The odds of a patient with melasma using sunscreen were 6.7 times the odds of a patient with postinflammatory hyperpigmentation using sunscreen ($P < .001$). Additional predictors for sunscreen use were female sex (OR = 3.8, $P = .0004$) and disease duration of ≥1 year (OR = 2.1, $P = .003$). In a multivariate analysis, the odds ratio of sunscreen use among African Americans compared to whites was 0.31 ($P = .008$).

Limitations: Limitations included recall bias, question misinterpretation, and reporter bias.

Conclusion: Patients diagnosed with postinflammatory hyperpigmentation, men, and those with disease duration <1 year reported lower sunscreen usage. These groups might benefit from increased counseling on sun-protective behaviors. (J Am Acad Dermatol 2017;76:841-6.)

Key words: broad spectrum; cutaneous hyperpigmentation; darker skin; melasma; postinflammatory hyperpigmentation; sun-protective behaviors; sun protection factor; sunscreen.

Photo-protective behaviors reduce the risk for skin cancer, prevent skin aging, and, additionally, are important adjuvant treatments for photo-exacerbated disorders.[1-3] Numerous studies have been conducted investigating the sun-protective habits of healthy individuals,[4] patients with skin cancer,[5] outdoor workers,[6] and those who frequently engage in outdoor recreational activities[7]; however, little is known about the sun-protective behaviors of patients with disorders of hyperpigmentation. Although often benign conditions, they can cause deleterious emotional and psychological

Abbreviations used:

PIH: postinflammatory hyperpigmentation
SPF: sun protection factor

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impact and have been reported to be among the top 5 reasons African Americans visit a dermatologist,[8] one of the top 10 diagnoses among Latino patients,[9] and 11th among the top 20 conditions seen by dermatologists.[10]

By the year 2042, nearly half of the US population will be composed of nonwhites.[11] As a result, the prevalence of and interest in the prevention and treatment of hyperpigmentation disorders is expected to increase as those with darker skin types are more susceptible to these disorders. We sought to examine the use of photo-protective behaviors and their association with demographic and clinical factors among individuals with cutaneous disorders of hyperpigmentation.

CAPSULE SUMMARY

- Sun protection is an important adjuvant treatment for hyperpigmentation disorders.
- Among patients with hyperpigmentation, 67.5% reported using a product containing sunscreen. Individuals with postinflammatory hyperpigmentation, men, and those with disease duration <1 year reported lower sunscreen usage.
- Patients with hyperpigmentation might benefit from increased counseling on sun-protective measures.

METHODS

This cross-sectional study was conducted on 404 adults with cosmetically bothersome cutaneous hyperpigmentation who sought dermatological care at Boston Medical Center or East Boston Neighborhood Health Center from February of 2015 to July of 2016. This study was approved by the Boston University Institutional Review Board. Of the 424 invited to take part in the survey, 20 declined to participate, giving a response rate of 95%. Information for the study was collected in 2 parts: an anonymous paper-based survey in participants' preferred language (English, Spanish, or Portuguese) and a clinical evaluation in which diagnosis and skin type were determined by a trained dermatologist. Those younger than 18 years of age, who were not proficient in English, Spanish, or Portuguese, and who were unable to complete the questionnaire were excluded. The survey contained questions pertaining to demographics, sunscreen use, sun protection factor (SPF) use, and sun-protective measures, including seeking shade and wearing hats. To examine sunscreen use and sun-protective behaviors, participants were asked, "Are you currently using a lotion, cream, or sunscreen with sun protection factor (SPF)? [yes, no, don't know]." Participants who answered yes continued to answer the following questions: "What sun protection factor (SPF) are you using? [10-20, 21-50, 51-100, >100, or don't know]," "How often do you re-apply sunscreen? [every 2 hours, 3x day, 2x day, 1x day, occasionally, or almost never]," and "Is your sunscreen broad spectrum? [yes, no, don't know]." This was followed by questions regarding other photo-protective habits: "On average, how many hours are you in the sun between 10 am to 4 pm? Weekends: [1 or less, 2, 3, 4, 5, 6] and Weekdays: [1 or less, 2, 3, 4, 5, 6]" and "When you are outdoors in the sun, how often do you do each of the following? Wear a hat: [rarely or never, sometimes, usually, always], Stay in the shade or under an umbrella: [rarely or never, sometimes, usually, always]."

Data analysis

Collected data was managed using Research Electronic Data Capture. Statistical analyses were performed using STATA/SE 13.0. Descriptive characteristics were studied by 3 diagnostic categories (melasma, postinflammatory hyperpigmentation (PIH), or other diagnosis of hyperpigmentation) depending on the clinical diagnosis patients received during the clinical evaluation. The chi-square test was used to find any statistically significant differences between groups ($P < .05$).

For sample size estimation, a power analysis was performed, with the current sample being powered to detect as small as a 0.15 difference in proportions at 90% power ($P = .05$). Bivariate and multivariate logistic regression analyses were created to examine the relationship between sunscreen use and race.

Models were controlled for the following potential confounding factors: sex, age (>45 or ≤45), level of education (high school diploma or less or college/graduate degree), visit type (first or follow up visit), disease duration (from the time the patient first developed skin hyperpigmentation to 12 months or less, >12 months to 5 years, or more than 5 years), and clinical diagnosis (melasma, PIH, or other hyperpigmentation diagnoses).

Two logistic regression models were created. Model I was adjusted for sex, age, level of education, duration of the disease, and visit type. Model II was adjusted for clinical diagnosis in addition to the confounders in model I.

RESULTS

With a response rate of 95%, a total of 404 participants completed the survey. Of the participants, 89.1% were women, 47.5% were Hispanic or

Latino, and 56.9% were 25-44 years of age. Participant basic demographic characteristics are summarized in Table I.

About 67.5% reported using a lotion, cream, or other skin product containing sunscreen, and of those, 91% used a sunscreen with a SPF of 21 or higher and 69.3% reapplied 1-3 times daily. Among sunscreen users, 48.5% were not sure if their sunscreen provided broad-spectrum protection. Those diagnosed with melasma used a SPF of 21 or higher ($P < .006$) and reapplied sunscreen ($P < .001$) more often than those diagnosed with PIH and other hyperpigmentation disorders (Table II). Additionally, those with melasma were more likely to attribute their condition to the sun (55.1%) when compared to PIH (12.1%) and other hyperpigmentation disorders (32.7%) ($P < .001$).

During peak hours of possible sun exposure, between 10 am and 4 pm, most participants reported staying outside for 1-2 hours on weekdays and weekends (84.7% and 76.1%, respectively). When outdoors, more than half of the patients rarely or never wore a hat (52.5%), and only 31.9% usually or always sought shade. Only 27 (21.7%) participants with PIH usually/always sought shade, compared with 65 (52.4%) with melasma and 32 (25.8%) with other hyperpigmentation disorders ($P = .001$). Clinical characteristics of participants by diagnosis are reported in Table II.

In the univariate analysis to investigate the association between sunscreen use and race, the odds of sunscreen use among African Americans were found to be significantly less when compared with whites (OR = 0.49, $P < .045$) (Supplemental Table I; available at http://www.jaad.org). When controlling for covariates in the multivariate analyses, including sex, age, level of education, visit type, and disease duration (model I), the odds ratio of sunscreen use among African Americans compared with whites remained significant and was reduced to 0.31 ($P = .008$). However, when type of clinical diagnosis was additionally controlled for (model II), African American race was no longer significantly associated with lower rates of sunscreen use, although the trend was still apparent (Supplemental Table I). Spearman ranked correlation found that race and skin type were significantly correlated at 60% ($P < .001$).

Supplemental Table II (available at http://www.jaad.org) reports in detail the factors controlled for in model II. Women were significantly more likely to use sunscreen than men (OR = 3.8, $P = .004$). Those with a disorder of hyperpigmentation for a duration of 1-5 years and >5 years were significantly more likely to use sunscreen than those who had the disorder for ≤12 months (OR = 2.4, $P = .003$ and OR = 3.5, $P = .002$, respectively). Additionally, when all other factors in the model were fixed, the specific clinical diagnosis of hyperpigmentation disorder, rather than race, seemed to be the strongest predictor of sunscreen use. In particular, the odds of a patient with melasma using sunscreen was 6.7 the odds of a patient with PIH using sunscreen ($P = .001$). Education level, which was also used as a proxy measure of income,[12] did not reach statistical significance in the odds of sunscreen use (Supplemental Table II).

Table I. Basic demographic characteristics of the study population (n = 404)

Characteristic	n (%)
Age, year	
18-24	27 (6.68%)
25-34	109 (26.98%)
35-44	121 (29.95%)
45-54	82 (20.30%)
≥55	65 (16.09%)
Sex	
Female	360 (89.11%)
Male	44 (10.98%)
Race (n = 395)*	
White	58 (14.36%)
African American	116 (28.71%)
Hispanic or Latino	192 (47.52%)
Asian	28 (6.93%)
Native American	1 (0.25%)
Education (n = 394)*	
Lower/elementary school	37 (9.39%)
Middle school	54 (13.71%)
High school	122 (30.96%)
College	107 (26.16%)
Graduate school	74 (18.78%)
Fitzpatrick skin type (n = 399)*	
Type I	3 (0.74%)
Type II	26 (6.44%)
Type III	118 (29.21%)
Type IV	135 (33.42%)
Type V	74 (18.32%)
Type VI	43 (10.64%)
Diagnosis (n = 398)	
Melasma	161 (40.45%)
PIH	138 (34.67%)
Other	99 (24.87%)

PIH, Postinflammatory hyperpigmentation.
*Sample size might vary due to missing data.

DISCUSSION

The prevalence of sunscreen use in our sample was high (67.5%) when compared to the reported rates of sunscreen use in the general population (15% in men and 30% in women).[4] However, this percentage approaches that for individuals with

Table II. Clinical characteristics of the study population

Attribute	n (%)	PIH mean, n (%)	Melasma mean, n (%)	Other mean, n (%)	*P* value[†]
Duration of hyperpigmentation (n = 349)*					
1-12 months	59 (16.91)	24 (43.64)	15 (27.27)	16 (29.09)	
1-5 years	131 (37.54)	41 (31.54)	58 (44.62)	31 (23.85)	.224
>5 years	159 (45.56)	58 (36.71)	56 (35.44)	44 (27.85)	
Attributed hyperpigmentation to the sun (n = 401)					
Yes	109 (26.98)	13 (12.15)	59 (55.14)	35 (32.71)	
No	134 (33.17)	86 (65.15)	21 (15.91)	25 (18.94)	<.001
Don't know	158 (39.11)	38 (24.36)	79 (50.64)	39 (25.00)	
Currently using sunscreen (n = 397)					
Yes	268 (67.51)	66 (25.00)	136 (51.52)	62 (23.48)	
No	122 (30.73)	66 (55.00)	18 (15.00)	36 (30.00)	<.001
Don't know	7 (1.76)	4 (57.14)	3 (42.86)	0 (0)	
Strength of SPF (n = 277)					
10-20	24 (8.66)	8 (33.33)	7 (29.17)	9 (37.50)	
21-50	134 (48.38)	36 (27.27)	64 (48.48)	32 (24.24)	.066
>50	119 (42.96)	25 (21.37)	70 (59.83)	22 (18.80)	
Frequency of reapplication of sunscreen/day (n = 274)					
Every 2 hours	21 (7.66)	5 (25.00)	12 (60.00)	3 (15.00)	
1-3 times	190 (69.34)	37 (19.68)	105 (55.85)	46 (24.47)	<.001
Occasionally	47 (17.15)	18 (38.30)	16 (34.04)	13 (27.66)	
Almost never	16 (5.84)	11 (68.75)	4 (25.00)	1 (6.25)	
Hours spent in the sun during weekends (n = 394)					
1-2 hours	300 (76.14)	110 (37.29)	123 (41.69)	62 (21.02)	
2-5 hours	71 (18.02)	18 (25.71)	27 (38.57)	25 (35.71)	.007
>5 hours	23 (5.84)	7 (30.43)	5 (21.74)	11 (47.83)	
Hours spent in the sun during weekdays (n = 386)					
1-2 hours	327 (84.72)	114 (35.40)	132 (40.99)	76 (23.60)	
2-5 hours	41 (10.62)	13 (31.71)	15 (36.59)	13 (31.71)	.299
>5 hours	18 (4.66)	5 (27.78)	5 (27.78)	8 (44.44)	
Wears a hat when in the sun (n = 394)					
Rarely/never	207 (52.54)	81 (39.71)	77 (37.75)	46 (22.55)	
Sometimes	109 (27.66)	39 (36.45)	47 (43.93)	21 (19.63)	.015
Usually/always	78 (19.80)	16 (20.78)	33 (42.86)	28 (36.36)	
Stay in shade when outside (n = 395)					
Rarely/never	129 (32.66)	56 (44.09)	37 (29.13)	34 (26.77)	
Sometimes	140 (35.44)	54 (38.57)	56 (40.00)	30 (21.43)	.001
Usually/always	126 (31.90)	27 (21.77)	65 (52.42)	32 (25.81)	
Use broad-spectrum sunscreen (n = 167)					
Yes	80 (47.90)	29 (36.25)	33 (41.25)	18 (22.50)	
No	6 (3.59)	2 (33.33)	2 (33.33)	2 (33.33)	.538
Don't know	81 (48.50)	20 (24.69)	38 (46.91)	23 (28.40)	

PIH, Postinflammatory hyperpigmentation; *SPF*, sun protection factor.
*Denominators might differ due to missing data.
[†]Generated through either chi-square test or Fisher's exact test where appropriate.

photosensitive disorders (59%),[13] a history of melanoma (45%-57%),[14] and outdoor workers (30%-100%).[6,15] In the only other study reporting sunscreen usage in those with hyperpigmentation, in particular melasma (n = 63), authors reported a lower rate (13.4%) than we found.[16] Our study reported usage from a much larger, predominantly female sample, which might account for this discrepancy. Women are more likely to adopt sun-protective behaviors[1,17] and commonly use cosmetic products containing sunscreen.[18] With regards to race, our findings were consistent with the literature that African Americans use sunscreen less frequently when compared with their white and Hispanic counterparts (Supplemental Table I).[7,19-22]

Among patients diagnosed with melasma, sun-protective measures such as using sunscreen (51.32%), seeking shade (52.4%), and wearing a hat (42.86%) were more commonly adopted when compared with those with PIH and other

hyperpigmentation disorders. The odds ratio of sunscreen use among participants with melasma was 6.7 times higher than use among participants with PIH (Supplemental Table II). Although all patients recruited were cosmetically bothered by their diagnosis, melasma is a condition that recurs and has more robust literature showing that it negatively impacts patient quality of life,[23-25] which in turn could motivate those with melasma to seek more care. Sunscreen is one of the cornerstones of treatment recommended by dermatologists, which might have contributed to the higher compliance in this subgroup.[26] In fact, those with melasma were more likely to attribute their condition to the sun (55.1%) when compared to PIH (12.1%) and other hyperpigmentation disorders (32.7%) (P = .<001). These findings suggest that participants' understanding about exacerbating factors might have played a role in the higher reported rate.

In contrast, participants with PIH were generally less likely to engage in sun-protective practices. PIH is more common in darker skin types (Fitzpatrick phototypes IV to VI), a group in which sun-protective measures are less frequently adopted.[21] Additionally, a possible clinical practice gap exists in the management of patients with PIH. Although photo-protection was the 3rd most common treatment option recommended to Caucasians with a diagnosis code inclusive of both hypo-and hyperpigmentation, it was only the 6th and 10th for African Americans and Asians, respectively, despite PIH being far more common in darker skinned individuals.[27]

Nearly half of those who reported using sunscreen were unsure if their sunscreen provided broad-spectrum protection. This is particularly important in darker skinned individuals as exposure to ultraviolet A and visible light has been shown to induce immediate and persistent pigment darkening and delayed tanning.[28,29] In addition, despite the high rates of sunscreen use, other protective measures such as always and usually wearing a hat (19.8%) and seeking shade (31.9%) were less frequently adopted. Only 21 participants (7.6%) reapplied sunscreen every 2 hours as recommended.[30] This highlights that even within a highly motivated patient population, there is still room for improved sun protection education.

The strengths of this study include use of a relatively large, racially and ethnically diverse sample. Limitations include the cross-sectional design, which might be subject to recall bias, question misinterpretation, and reporter bias. In addition, missing data and our largely female population limit the generalizability of our findings. The difference between the percentages in sex might be viewed as a limitation of this study, potentially leading to bias.

Our study demonstrates many interesting and novel findings regarding photo-protective behaviors of patients with cutaneous disorders of hyperpigmentation. The surprisingly high rate of overall sunscreen use gives credence to the notion that cosmetically disfiguring diagnoses are highly motivational factors. The lower perceived risk of sunburn and skin cancer among dark skinned individuals might make interventions solely based on skin cancer prevention less convincing to this patient population. Although health-based interventions improve skin cancer knowledge, it does not always improve sun-protective behaviors.[31-33] It is plausible that future sun safety campaigns emphasizing the association of ultraviolet exposure with aging and development of hyperpigmentation might be a suitable strategy to increase compliance in darker skinned populations.

REFERENCES

1. Buller DB, Cokkinides V, Hall HI, et al. Prevalence of sunburn, sun protection, and indoor tanning behaviors among Americans: review from national surveys and case studies of 3 states. *J Am Acad Dermatol*. 2011;65(5):S114-S123.
2. Hughes MCB, Williams GM, Baker P, Green AC. Sunscreen and prevention of skin aging: a randomized trial. *Ann Intern Med*. 2013;158(11):781-790.
3. Briley JJ Jr, Lynfield YL, Chavda K. Sunscreen use and usefulness in African-Americans. *J Drugs Dermatology*. 2007;6(1):19-22.
4. Holman DM, Berkowitz Z, Guy GP, Hawkins NA, Saraiya M, Watson M. Patterns of sunscreen use on the face and other exposed skin among US adults. *J Am Acad Dermatol*. 2015;73(1):83-92.
5. Oliveria SA, Shuk E, Hay JL, et al. Melanoma survivors: health behaviors, surveillance, psychosocial factors, and family concerns. *Psychooncology*. 2013;22(1):106-116.
6. Reinau D, Weiss M, Meier CR, Diepgen TL, Surber C. Outdoor workers' sun-related knowledge, attitudes, and protective behaviours: a systematic review of cross-sectional and interventional studies. *Br J Dermatol*. 2013;168(5):928-940.
7. Buller DB, Andersen PA, Walkosz BJ, et al. Compliance with sunscreen advice in a survey of adults engaged in outdoor winter recreation at high-elevation ski areas. *J Am Acad Dermatol*. 2012;66(1):63-70.
8. 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.
9. Sanchez MR. Cutaneous diseases in Latinos. *Dermatol Clin*. 2003;21(4):689-697.
10. Wilmer EN, Gustafson CJ, Ahn CS, Davis SA, Feldman SR, Huang WW. Most common dermatologic conditions encountered by dermatologists and nondermatologists. *Cutis*. 2014;94(6):285-292.
11. Colby SL, Ortman JM. Projections of the size and composition of the US population: 2014 to 2060. *Curr Popul Reports*.

Available at: http://www.census.gov/content/dam/Census/library/publications/2015/demo/p25-1143.pdf. Accessed February 8, 2017.

12. White CM, St. John PD, Cheverie MR, Iraniparast M, Tyas SL. The role of income and occupation in the association of education with healthy aging: results from a population-based, prospective cohort study. *BMC Public Health*. 2015;15(1):1181.
13. Yang SY, Bernstein I, Lin DQ, Chong BF. Photoprotective habits of patients with cutaneous lupus erythematosus. *J Am Acad Dermatol*. 2013;68(6):944-951.
14. Warren M, McMeniman E, Adams A, De'Ambrosis B. Skin protection behaviour and sex differences in melanoma location in patients with multiple primary melanomas. *Australas J Dermatol*. 2015; http://dx.doi.org/10.1111/ajd.12373.
15. Hall DM, McCarty F, Elliott T, Glanz K. Lifeguards' sun protection habits and sunburns: association with sun-safe environments and skin cancer prevention program participation. *Arch Dermatol*. 2009;145(2):139-144.
16. Negishi K, Kushikata N, Tezuka Y, et al. Study of the incidence and nature of "very subtle epidermal melasma" in relation to intense pulsed light treatment. *Dermatologic Surg*. 2004;30(6):881-886.
17. Falk M, Anderson CD. Influence of age, gender, educational level and self-estimation of skin type on sun exposure habits and readiness to increase sun protection. *Cancer Epidemiol*. 2013;37(2):127-132.
18. Abroms L, Jorgensen CM, Southwell BG, Geller AC, Emmons KM. Gender differences in young adults' beliefs about sunscreen use. *Health Educ Behav*. 2003;30(1):29-43.
19. Chien AL, Suh J, Cesar SSA, et al. Pigmentation in African-American skin decreases with skin aging. *J Am Acad Dermatol*. 2016;75(4):782-787.
20. Holman DM, Berkowitz Z, Guy GP, Hartman AM, Perna FM. The association between demographic and behavioral characteristics and sunburn among U.S. adults - National Health Interview Survey, 2010. *Pred Med*. 2014;63:6-12.
21. Pichon LC, Mayer JA, Slymen DJ, Elder JP, Lewis EC, Galindo GR. Ethnoracial differences among outdoor workers in key sun-safety behaviors. *Am J Prev Med*. 2005;28(4):374-378.
22. Pichon LC, Corral I, Landrine H, Mayer JA, Norman GJ. Sun-protection behaviors among African Americans. *Am J Prev Med*. 2010;38(3):288-295.
23. Pawaskar MD, Parikh P, Markowski T, McMichael AJ, Feldman SR, Balkrishnan R. Melasma and its impact on health-related quality of life in Hispanic women. *J Dermatolog Treat*. 2007;18(1):5-9.
24. Ikino JK, Nunes DH, VPM da Silva, Fröde TS, Sens MM. Melasma and assessment of the quality of life in Brazilian women. *An Bras Dermatol*. 2015;90(2):196-200.
25. Pichardo R, Vallejos Q, Feldman SR, et al. The prevalence of melasma and its association with quality of life in adult male Latino migrant workers. *Int J Dermatol*. 2009;48(1):22-26.
26. Akamine KL, Gustafson CJ, Davis SA, Levender MM, Feldman SR. Trends in sunscreen recommendation among US physicians. *JAMA Dermatology*. 2014;150(1):51.
27. Kang SJ, Davis SA, Feldman SR, McMichael AJ. Dyschromia in skin of color. *J Drugs Dermatol*. 2014;13(4):401-406.
28. Castanedo-Cazares JP, Hernandez-Blanco D, Carlos-Ortega B, Fuentes-Ahumada C, Torres-Álvarez B. Near-visible light and UV photoprotection in the treatment of melasma: a double-blind randomized trial. *Photodermatol Photoimmunol Photomed*. 2014;30(1):35-42.
29. Maddodi N, Jayanthy A, Setaluri V. Shining light on skin pigmentation: the darker and the brighter side of effects of UV radiation. *Photochem Photobiol*. 2012;88(5):1075-1082.
30. Lim HW, Cooper K. The health impact of solar radiation and prevention strategies. *J Am Acad Dermatol*. 1999;41(1):81-99.
31. Tuong W, Armstrong AW. Effect of appearance-based education compared with health-based education on sunscreen use and knowledge: a randomized controlled trial. *J Am Acad Dermatol*. 2014;70(4):665-669.
32. Mahler HIM, Fitzpatrick B, Parker P, Lapin A. The relative effects of a health-based versus an appearance-based intervention designed to increase sunscreen use. *Am J Heal Promot*. 1997;11(6):426-429.
33. Armstrong AW, Watson AJ, Makredes M, Frangos JE, Kimball AB, Kvedar JC. Text-message reminders to improve sunscreen use: a randomized, controlled trial using electronic monitoring. *Arch Dermatol*. 2009;145(11):1230-1236.

Supplemental Table I. Logistic regression models for the relationship between sunscreen use and race

	Univariate analysis				Multivariate model I*				Multivariate model II†			
Race	**Odds ratio**	**CI**		***P***	**Odds ratio**	**CI**		***P***	**Odds ratio**	**CI**		***P***
African American	0.49	0.24	0.98	.045	0.31	0.13	0.74	.008	0.45	0.18	1.1	.09
Asian	1.05	.37	2.95	.932	1.05	0.30	3.71	.9	1.0	0.26	3.9	.97
Hispanic or Latino	0.87	.45	1.70	.702	1.08	0.46	2.5	.8	0.82	0.32	2.0	.67

CI, Confidence interval.
*Model I is adjusted for gender, age, level of education, duration of the disease, and whether this was the first patient's visit or not.
†Model II is adjusted for the same confounders in model I and for clinical diagnosis.

Supplemental Table II. Factors associated with better sunscreen use among patients with hyperpigmentation disorder

	Sunscreen use					
Dependent variables	**Yes**	**No**	**Model II**	***P* value**	**Confidence interval**	
Race						
White	43 (74.14)	15 (25.86)			Reference	
African American	65 (58.56)	46 (41.44)	0.45	.09	0.18	1.14
Asian	21 (75.00)	7 (25.00)	1.02	.97	0.26	3.91
Hispanic	132 (71.74)	52 (28.26)	0.82	.67	0.32	2.05
Sex						
Male	18 (42.86)	24 (57.14)			Reference	
Female	250 (71.84)	98 (28.16)	3.8	.004	1.5	9.5
Age						
>45 years	97 (68.79)	44 (31.21)			Reference	
≤45 years	171 (68.67)	78 (31.33)	0.91	.96	0.51	1.90
Level of education						
High school diploma or less	137 (66.18)	70 (33.82)			Reference	
College/graduate degree	125 (72.25)	48 (27.75)	1.82	.1	0.89	3.74
Visit type						
First visit	117 (66.10)	60 (33.90)			Reference	
Second visit	120 (70.18)	51 (29.82)	0.86	.63	0.48	1.5
Duration of the disease						
1-12 months	28 (47.46)	31 (52.54)			Reference	
13 months-5 years	86 (68.25)	40 (31.75)	2.4	.032	1.08	5.48
>5 years	112 (72.73)	42 (27.27)	3.5	.002	1.57	7.88
Clinical Diagnosis						
PIH	66 (50.00)	66 (50.00)			Reference	
Melasma	136 (88.31)	18 (11.69)	6.7	<.001	3.07	14.6
Other	62 (63.27)	36 (36.73)	1.4	.3	0.70	3.05

PIH, Postinflammatory hyperpigmentation.