JAMA Dermatology | Review

UV Exposure and the Risk of Cutaneous Melanoma in Skin of Color
A Systematic Review

Fabiana C. P. S. Lopes, MD; Marc G. Sleiman, BS; Kate Sebastian, RN, MPH; Roxanne Bogucka, MLIS, AHIP; Elizabeth A. Jacobs, MD, MAPP; Adewole S. Adamson, MD, MPP

IMPORTANCE While current evidence supports UV exposure as an important risk factor for cutaneous melanoma in fair-skinned populations, the evidence for this association in skin of color is less certain.

OBJECTIVE To critically assess and synthesize the published data regarding the association between UV exposure and the risk of cutaneous melanoma in skin of color.

EVIDENCE REVIEW A search was conducted including PubMed, Cochrane, and Web of Science databases from database origin to June 3, 2020. Only peer-reviewed original studies were screened in full text. Eligible studies analyzed UV exposure as a risk factor for cutaneous melanoma in people with skin of color, which was defined broadly as any race/ethnicity other than non-Hispanic White, Fitzpatrick skin types IV through VI, or tanning ability of rarely or never burns. Measures of UV exposure included UV index, irradiance, latitude, history of phototherapy, and history of sunburn. Evidence quality was assessed using criteria from the Oxford Centre for Evidence-Based Medicine.

FINDINGS After duplicate removal, 11 059 database records were screened, 548 full-text articles were assessed, and 13 met inclusion criteria. Study types included 7 ecological studies, 5 cohort studies, and 1 case-control study. All studies used race and/or ethnicity to categorize the participants, and more than 7700 melanomas in skin of color were included. Of the 13 studies that met inclusion criteria, 11 found no association between UV exposure and melanoma in skin of color, 1 study showed a small positive relationship in Black males, and 1 showed a weak association in Hispanic males. All studies were of moderate to low quality (Oxford Centre ratings 2b to 4).

CONCLUSIONS AND RELEVANCE In this systematic review, the evidence suggests that UV exposure may not be an important risk factor for melanoma development in people with skin of color. Current recommendations promoting UV protection for melanoma prevention in skin of color are not supported by most current studies. However, evidence is of moderate to low quality, and further research is required to fully elucidate this association.

JAMA Dermatol. doi:10.1001/jamadermatol.2020.4616
Published online December 16, 2020.

Editorial
Author Audio Interview
Supplemental content

Author Affiliations: Division of Dermatology, Department of Internal Medicine, Dell Medical School, The University of Texas at Austin (Lopes, Sebastian, Adamson); LIVESTRONG Cancer Institutes, Dell Medical School, The University of Texas at Austin (Sleiman, Adamson); Pritzker School of Medicine, The University of Chicago, Chicago, Illinois (Sleiman); Life Science Library, University of Texas Libraries, The University of Texas at Austin (Bogucka); Department of Internal Medicine, Dell Medical School, The University of Texas at Austin (Jacobs); Associate Editor and Web Editor, *JAMA Dermatology* (Adamson).

Corresponding Author: Adewole S. Adamson, MD, MPP, Division of Dermatology, Department of Internal Medicine, Dell Medical School at The University of Texas at Austin, 1601 Trinity St, Stop Z0900, Austin, TX 78712 (adewole.adamson@austin.utexas.edu).

Melanoma is a potentially deadly form of skin cancer, and its incidence has risen dramatically over time, especially among fair-skinned populations.[1] Melanoma incidence is much lower among people with skin of color; however, melanoma is often diagnosed at later stages with resulting lower survival rates.[2] As a result, there has been increasing interest in melanoma prevention within this population to reduce this health care disparity.[3]

Exposure to UV light is the best studied and most consistent modifiable risk factor associated with melanoma.[4] Numerous studies, including meta-analyses, have consistently demonstrated that increasing UV exposure is associated with higher rates of melanoma.[4,5] However, much of the work demonstrating this association has been conducted exclusively in fair-skinned populations. In 2018, when the US Preventive Services Task Force evaluated the evidence for recommending that clinicians counsel children and young adults about minimizing exposure to UV radiation, its grade B recommendation only applied to individuals with fair skin types.[6] Despite this recommendation, the American Academy of Dermatology and other skin cancer organizations continue to recommend UV protection for skin cancer prevention, including melanoma prevention in skin of color.[7]

To our knowledge, there has been no comprehensive systematic review to date examining the association between UV exposure and melanoma in populations with skin of color. The objective of this study was to critically assess and synthesize the published data regarding the association of UV exposure with the risk of cutaneous melanoma in skin of color.

Methods

This systematic review was registered in the PROSPERO database (ID: CRD42019140514) and was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline.[8] This research project was reviewed by the University of Texas at Austin Institutional Review Board and determined to be non–human subjects research.

Search Strategy

Comprehensive searches of the Cochrane Library, the legacy version of PubMed, Web of Science Core Collection, KCI-Korean Journal Database, MEDLINE, Russian Science Citation Index, and SciELO Citation Index were conducted on June 26, 2019, and June 3, 2020. Search strategies for the concepts of melanoma and UV exposure were developed with input from clinical research team members in conjunction with an experienced health sciences librarian (R.B.), who conducted the searches.

Given that UV exposure can be from various sources, we used a broad array of terms to be as inclusive as possible, including *ultraviolet*, *ultra-violet*, *ultra violet*, *actinic rays sunburn*, *sunburned*, *sunburning*, *sunburnlike*, *sunburns*, *sunburnt*, *burn*, *burns*, *burned*, *burnt*, *sun exposure*, *tanning*, *tanning beds*, *tanning lamps*, *indoor tanning*, *tanning booths*, *sunlamps*, *suntan*, *suntans*, *suntanned*, and *suntanning*. Full search strategy information is presented in the eAppendix in the Supplement.

At the conclusion of database search and screening, a forward and reverse citation search of all final eligible articles was conducted by 2 reviewers (F.C.P.S.L. and M.G.S.) to ensure a comprehensive collection of literature. The reverse citation search consisted of a review of all references within the final articles, and the forward citation search used Google Scholar to examine all records that cited the final articles. Any potentially eligible records discovered through this process were screened according to established criteria and included as appropriate.

Study Selection

The articles were collected and managed using Covidence software, a web-based program used to streamline the systematic review process.[9] Two researchers (F.C.P.S.L. and M.G.S.) independently screened titles and abstracts for inclusion using the eligibility criteria. If the abstract was unavailable or there was not enough information to decide on initial inclusion or exclusion, the article was kept for full-text review. If both reviewers agreed that the study did not meet eligibility criteria, the study was excluded. Any disagreements were settled by consensus including a third investigator (A.S.A. or K.S.).

Inclusion and Exclusion Criteria

We included only published articles in peer-reviewed journals that included human data and were written in or translated into English. Study designs considered included ecological, observational, prospective/retrospective cohort, case-control, and randomized clinical trials. We only included studies in which UV exposure preceded the outcome of melanoma diagnosis. We excluded articles that examined transplant recipients, immunosuppressed people, or individuals with significantly elevated melanoma risk (eg, history of xeroderma pigmentosum). We excluded articles focused on non-cutaneous (eg, ocular, mucosal) melanoma. We also excluded any in vitro studies.

Key Points

Question What is the association between UV exposure and the risk of cutaneous melanoma in skin of color?

Findings Thirteen studies with more than 7700 melanomas in people with skin of color were analyzed; 11 studies showed no association between melanoma and UV exposure, and 2 studies showed small, statistically significant positive associations only among Black and Hispanic males. The studies included were of moderate to low quality.

Meaning The association between UV exposure and melanoma is weak in skin of color; there is limited evidence supporting UV protection for melanoma prevention in skin of color.

People with skin of color constitute a wide range of racial and ethnic groups with varying melanin concentrations and varying susceptibility to UV-induced skin damage.[10] Our definition of skin of color was based on race/ethnicity and tanning ability and included the following: all races/ethnicities (eg, African, Asian, Pacific Islander, Indigenous, Hispanic) except for non-Hispanic White individuals, Fitzpatrick skin type (IV-VI), or tanning ability (rarely or never burns). While there is no criterion-standard definition, these categories are in line with previous studies defining skin of color.[7,10]

An objective assessment of an individual's UV exposure over time is difficult to quantify. Within the literature, there are various methods of measuring UV exposure, including occupational exposure, childhood exposure, sunburn history, vacations to tropical destinations, measures of latitude, phototherapy sessions, tanning bed sessions, UV flux, UV index, irradiance, and estimated time spent outdoors. We included articles that attempted to quantify UV exposure by any of the aforementioned measurement methods.

Quality Assessment

To assess the overall evidence quality of each study, 2 reviewers (F.C.P.S.L. and M.G.S.) independently used guidelines provided by the Centre for Evidence-Based Medicine at Oxford.[11] Studies were classified based on the "Therapy/Prevention, Aetiology/Harm" category, with 1a being the best quality and 5 being the poorest quality. Any discrepancies in the assessments between the initial reviewers were discussed, and if no consensus was reached, a third reviewer (A.S.A.) made a final designation.

Data Synthesis and Statistical Analysis

The following data were extracted for analysis from each record: author, year of publication, study location, type of study, skin of color classification, UV exposure classification, study period, total number of melanomas, total number of melanomas in skin of color, and the association between UV exposure and melanoma in skin of color.

Results

Literature Search

A total of 16 932 records were identified. After the removal of 5873 duplicates, 11 059 unique records were screened. Of these, 10 511 records were excluded during the title and abstract screening phase,

and 537 were excluded during full-text review. Eleven articles from the database search met eligibility criteria for inclusion and were subjected to further analysis. Two additional articles were discovered through forward citation search for a total of 13 articles (**Figure**).

Study Characteristics

Seven studies were ecological studies, 5 were retrospective cohort studies, and 1 was a case-control study. Six studies were conducted in the US, 3 in Korea, 1 in Taiwan, 1 in India, 1 in Chile, and 1 was multinational. All studies used race and/or ethnicity to group the participants, with a few supplementing racial/ethnic classifications with Fitzpatrick skin type. Participants' UV exposure was categorized in various ways across studies, including latitude, UV index, exposure to phototherapy, UV flux, ozone, altitude, sunburn history, surface UV-B, and birthplace UV irradiance. The period and follow-up studied varied from 3 to 38 years, with the shortest being from 1982 to 1985 and the longest being from 1973 to 2011 (**Table**[12-24]).

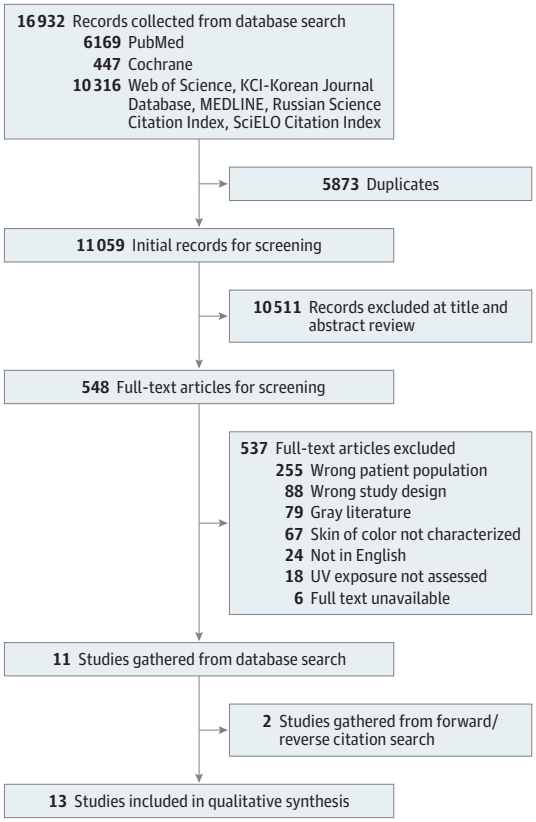
Ten of the 13 studies reported data on the total number of melanomas diagnosed and melanomas reported in groups with skin of color.[12-14,16,18-22,24] Among these, a total of 439 009 melanomas were identified, but only 7727 (1.76%) were in populations with skin of color. In 1 study, the intent was to collect the number of melanomas; however, zero melanomas were found in the group of patients exposed to narrowband UV-B (nbUVB) phototherapy.[17] The remaining 2 studies did not report specific numbers of melanoma but rather compared incidence rates between the general population and populations with skin of color.[15,23]

Studies Without an Association Between UV Exposure and Melanoma

Eleven of the 13 studies analyzed showed no association between UV exposure and melanoma in skin of color. Among the 6 US-based studies, 3 used the Surveillance, Epidemiology, and End Results (SEER) cancer registry, which is a program of the National Cancer Institute.[12,14,22] In the study by Pennello et al,[22] SEER data on melanoma were analyzed for 1973 to 1994 along with UV-B levels related to latitude, altitude, and sky cover. The authors found that melanoma in Black individuals was not associated with UV-B levels. Eide and Weinstock[14] used SEER data from 1992 to 2000, and findings showed that while there was an association between UV index, latitude, and melanoma in White individuals, there was no association in Black individuals, Hispanic individuals, Native American individuals, or Asian/Pacific Islander individuals. Adams et al[12] used SEER data from 1973 to 2011 and found that UV radiation exposure (stratified into low, medium, and high) and incidence of melanoma were not associated among Black men and women, but they were among White men and women.

Park et al[21] conducted a prospective examination of UV exposure and melanoma among a multiethnic cohort, which included Latin American, Japanese American, and Native American people but excluded African American individuals. Among non-White/multiracial individuals in the multiethnic cohort, there was no association between cutaneous melanoma and well-established risk factors, such as ever being sunburned, lifetime number of sunburns, age at first sunburn, and family history of melanoma. In a US-based case-control study, Wojcik et al[24] found no association between early UV exposure and melanoma among Hispanic patients. There was, however, a significant association between these variables among non-Hispanic White patients.

Figure. Flowchart Outline of the Database Search and Screening Process



In studies outside of the US, there was also limited evidence that melanoma was associated with UV exposure in skin of color. A 1992 study by Krishnamurthy[19] examined the geography of nonocular melanoma in India and showed a statistically nonsignificant association of melanoma with latitude. Three Korean studies examined the association between exposure to phototherapy and the risk of melanoma. In a retrospective study by Jo et al[17] of 445 patients with nbUVB with Fitzpatrick skin phototype III to V found no evidence for increase in melanoma after a relatively short mean follow-up time of 34.4 months. In 2019, Kim et al[18] compared incidence of melanoma in patients with vitiligo vs controls without vitiligo stratified by phototherapy and found no difference in risk of melanoma. In a Korean nationwide population-based cohort study of 60 231 patients with vitiligo, Bae et al[13] concluded that the number of nbUVB sessions was not associated with an increase in melanoma risk. Similar to the Korean studies, Lin et al[20] evaluated the association of differing levels of nbUVB phototherapy with the risk of melanoma in Taiwanese patients with psoriasis. Their nationwide retrospective cohort study conducted between 2000 and 2013 found no significant difference between short-term and long-term nbUVB and melanoma incidence.[20] Only 1 melanoma was diagnosed between both groups.

Godar et al[15] examined cutaneous melanoma using data encompassing more than 50 countries and spanning 5 continents, collected from the International Agency for Research on Cancer. Their study found no significant association between increased UV dosage and melanoma incidence for any skin type, including among non-Hispanic White indivduals.[15]

Table. Summary of Study Characteristics and Quality Assessment

Source	Location	Type of study	Race/ethnicity (FST)	UV exposure type	Study period	Total melanomas, No.	Melanomas in skin of color, No.	Association between UV exposure and melanoma in skin of color	Quality
Adams et al,[12] 2016	US	Ecological	Black, White	Latitude	1973-2011	269 561	1400	No association	2c
Bae et al,[13] 2020	Korea	Retrospective cohort	Asian	nbUVB phototherapy	2007-2017	34	34	No association	2b
Eide and Weinstock,[14] 2005	US	Ecological	Asian/Pacific Islander, Black, Hispanic White, Native American, and non-Hispanic White	Latitude and mean UV Index	1992-2001	53 186	2357	No association	2c
Godar et al,[15] 2016	Australia, US, Europe, China, Japan, South America, Italy, India	Ecological	Non-Hispanic White (FST I-III); Asian, Hispanic, Latino, Polynesian (FST III-IV); African American (FST IV-VI); Eastern Indian (FST IV-V) and Mediterranean (FST III-IV)	Latitude	2003-2007	Not reported (only incidence reported)	Not reported (only incidence reported)	No association	2c
Hu et al,[16] 2004	US	Ecological	Black, Hispanic, and non-Hispanic White	Latitude and mean UV index	1989-2000	64 305	2792	Positive correlation in Black males only; no association in Black women, Hispanic men, or Hispanic women	2c
Jo et al,[17] 2011	Korea	Retrospective cohort	Asian (FST III-V)	nbUVB phototherapy	1998-2009	Not reported (only incidence reported)	0 of 445 nbUVB patients	No association	4
Kim et al,[18] 2020	Korea	Retrospective cohort	Asian	Photochemotherapy or phototherapy	2005-2017	313	313	No association	2b
Krishnamurthy,[19] 1992	India	Ecological	Indian	Latitude, ozone, altitude, and UV flux	1982-1985	246	246	No association	2c
Lin et al,[20] 2019	Taiwan	Retrospective cohort	Asian (FST III-V)	Short-term nbUVB and long-term nbUVB	2000-2013	1	1	No association	2b
Park et al,[21] 2012	US	Prospective cohort	Non-Hispanic White, Japanese American, Latinx American, Native Hawaiian, and multiracial (excluding African American)	Sunburn history	1993-2007	993	181	No association	2b
Pennello et al,[22] 2000	US	Ecological	Black, White	Surface UV-B	1973-1994	48 993	301	No association	2c
Rivas et al,[23] 2011	Chile	Ecological	Hispanic	Latitude and UV index	2003-2007	Not reported (only incidence reported)	Not reported (only incidence reported)	Weak association in males only	2c
Wojcik et al,[24] 2019	US	Case control	Hispanic and non-Hispanic White	Birthplace UV irradiance	1988-2013	1377	102	No association	3b

Abbreviations: FST, Fitzpatrick skin type; nbUVB, narrowband UV-B.

Studies With an Association Between UV Exposure and Melanoma

Two studies showed a statistically significant, positive association between UV exposure and cutaneous melanoma but only in Black and Hispanic males, respectively.[16,23] Using the state cancer registries of New York, New Jersey, Illinois, California, Texas, and Florida between 1995 and 1999, Hu et al[16] examined the associations between age-adjusted melanoma incidence rates, mean annual UV index, and latitude among White, Hispanic, and Black individuals. The only significant association was among Black males, specifically a positive correlation between melanoma incidence and UV index and a negative correlation between melanoma incidence and latitude. This association was not seen in Black females or in White and Hispanic individuals of either sex. Rivas et al[23] examined the association of UV index and latitude with cutaneous melanoma in a Chilean population. A weak inverse association was found overall between melanoma rates and latitude only among males.

Quality Assessment

According to guidelines provided by the Centre for Evidence-Based Medicine at Oxford,[11] 4 studies were graded as 2b, 7 studies were graded as 2c, 1 study was graded as 3b, and 1 study was graded as 4 (Table). All classifications represent evidence of moderate to low quality based on study designs.

Discussion

The findings of this systematic review suggest that UV exposure is not an important risk factor for melanoma development in people with skin of color. This present study contrasts with multiple systematic reviews and meta-analyses in fair-skinned populations that demonstrate a consistent relationship between UV exposure and melanoma.[4,5] Across all 13 studies, which included more than 7700 melanomas in skin of color from diverse racial and ethnic populations, there was little evidence of UV as a risk factor for melanoma. However, the quality of the evidence is moderate to low.

Of 13 included articles, 11 showed no association between UV exposure and melanoma risk in skin of color. The largest studies in the US used SEER cancer registries, which represent a geographically diverse group of registries that cover 35% of the US population, yet each of these SEER-based studies failed to show an association between UV exposure and melanoma in skin of color.[25] Unfortunately, these studies are limited because it is not possible to know the specific amount of UV exposure of each individual person with melanoma within the population. However, among White individuals in the SEER database, there was a consistent association between these broad UV measures and melanoma.

Other US-based studies included in our analysis attempted to overcome the issue of unaccounted individual UV exposure in ecological studies. Park et al[21] used a prospective cohort design; however, they failed to show an association between well-established risk factors and melanoma (both in situ and invasive). However, the study did show an association among the multiethnic cohort participants with a high sunburn susceptibility phenotype index, an index created by the authors based on 4 phenotypic factors: hair color, eye color, tanning ability, and skin's reactivity to acute sunlight.[21] This finding highlights that while UV exposure may be less important in people with skin of color as a group, there may be a subset of people with high-risk features predisposing them to melanoma. In another US-based study, Wojcik et al[24] used a case-control design and found no association between childhood UV exposure and melanoma among Hispanic patients. High UV exposure during childhood is one of the strongest modifiable risk factors for melanoma development.[4]

Studies conducted outside the US also consistently failed to show an association between UV exposure and melanoma. Many of these studies were conducted in east Asia and included analysis of patients exposed to nbUVB for disorders such as psoriasis and vitiligo. While nbUVB exposure may not be equivalent to sun-related UV exposure, it is reassuring, as nbUVB is a valuable treatment for these various skin disorders. Importantly, among fair-skinned populations, data suggest no association between nbUVB and increased risk of melanoma.[26] Therefore, it may be unsurprising that no association was found in people with skin of color, who are already at low risk for melanoma development at baseline.

Among the studies analyzed, 2 showed an association between UV exposure and melanoma in skin of color. In the study by Hu et al,[16] the association was only seen in Black men but not for Black women, Hispanic men and women, or surprisingly even for White men and women, who have the highest risk of UV-associated melanoma. Rivas et al[23] also showed an association between melanoma and skin of color based on latitude between cities in Chile. However, as an important caveat, the city in which melanoma incidence was higher contained a significant population of individuals of Croatian origin with skin types II and III.[23] This finding highlights a central problem in the interpretation of data based on race, ethnicity, and country: these measures are imperfectly related to cutaneous melanin concentration, which is an important factor related to the risk of developing melanoma.

Ten of the 13 studies reported data on the total number of melanomas diagnosed and melanomas reported in skin of color.[12-14,16,18-22,24] Data were retrieved from state, regional, and national cancer registries (3 from SEER, 2 from Korean National Health Insurance, 1 from the National Cancer Registry Project of the Indian Council of Medical Research, 1 from the Taiwan National Health Insurance Database, and 3 from US states' cancer registries); therefore, the quality of the studies are dependent on the quality of reporting to these entities.

While most of the studies analyzed in this systematic review did not differentiate the histologic subtypes of melanoma diagnosed, epidemiologic studies in skin of color indicate that the predominant melanoma subtype is acral lentiginous melanoma (ALM) on the lower extremities, palms, soles, and nail beds.[27] Acral lentiginous melanomas are not considered UV associated; therefore, even if UV was a risk factor for melanoma in skin of color, only a small proportion of melanomas could even theoretically be attributed to UV exposure. It should be noted, however, that while ALMs predominate in skin of color, the incidence rate of acral melanoma is similar across all racial and ethnic groups, indicating a unique cause.[27] Among the studies included in the systematic review, only the study by Park et al[21] categorized cases of melanoma by histologic type and excluded ALM from the cal-

culations of risk. Therefore, it is unknown whether the exclusion of ALM from the analysis in other studies would have led to different conclusions about the association between melanoma and UV exposure.

Limitations

This systematic review has some limitations. Most studies included only race and ethnicity, which may not accurately correlate with melanin index or sunburn propensity; therefore, certain subpopulations within these groups may have differing susceptibility to UV as a risk factor for melanoma. It is also possible that, in some cases, race and/or ethnicity may have been misclassified within the included studies. Quantifying UV exposure is challenging and differed across multiple studies, making comparisons between studies difficult. Exposure to UV and the outcome of melanoma may be separated by long periods of time, which may not have been captured in the studies with short follow-up. Exposure to UV is also an important contributor to keratinocyte carcinoma, and photoprotection may be warranted for this reason; however, to our knowledge, no systematic study of the strength of the association of UV exposure and keratinocyte carcinoma has been conducted in skin of color. Finally, the quality of these studies was moderate to low; therefore, high-quality studies should be pursued in the future to answer this important clinical question.

Conclusions

Taken together, the results of this systematic review question the notion that patients with skin of color should practice UV protection to reduce their risk of melanoma.[7] The promotion of UV protection for melanoma prevention in skin of color should be tempered. Increased UV exposure does not appear to be associated with melanoma risk in skin of color. However, photoprotection may be associated with benefits in other UV-associated disorders, such as photoaging, melasma, and postinflammatory hyperpigmentation. Importantly, our analysis excluded transplant recipients, immunosuppressed people, and individuals with potentially significantly elevated melanoma risk (eg, history of xeroderma pigmentosum). Overall, findings of the present study show that the evidence is of moderate to low quality; nevertheless, current guidelines suggesting photoprotection for melanoma prevention in skin of color are not supported by the current literature. Research to elucidate melanoma risk factors in populations with skin of color should be sought to improve outcomes and reduce associated health disparities.

ARTICLE INFORMATION

Accepted for Publication: October 27, 2020.

Published Online: December 16, 2020. doi:10.1001/jamadermatol.2020.4616

Author Contributions: Dr Lopes and Mr Sleiman had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Lopes, Sleiman, Jacobs, Adamson.
Acquisition, analysis, or interpretation of data: Lopes, Sleiman, Sebastian, Bogucka, Adamson.
Drafting of the manuscript: Lopes, Sleiman, Bogucka, Adamson.
Critical revision of the manuscript for important intellectual content: Lopes, Sleiman, Sebastian, Jacobs, Adamson.
Statistical analysis: Adamson.
Obtained funding: Adamson.
Administrative, technical, or material support: Lopes, Sebastian, Bogucka, Jacobs, Adamson.
Supervision: Lopes, Jacobs, Adamson.

Conflict of Interest Disclosures: Mr Sleiman reported receiving grants from LIVESTRONG Cancer Institutes at the University of Texas Dell Medical School for living expenses as a Summer Undergraduate Research Fellow outside the submitted work; the institution had no specific criteria for the subject, design, data collection, analysis, or writing of the research paper or any other aspect during the conduct of the study. Dr Adamson reported serving as a member of the American Academy of Dermatology Task Force on Skin Cancer and Skin of Color. No other disclosures were reported.

Funding/Support: Dr Adamson is supported by the Dermatology Foundation Public Health Career Development Award, by the National Institutes of Health under grant NIH UL1 TR002645, by Meredith's Mission for Melanoma, and by the Brown Skin Too Foundation. Mr Sleiman was supported by the LIVESTRONG Foundation for his work as a research fellow in the LIVESTRONG Cancer Institutes, a division of the University of Texas Dell Medical School.

Role of the Funder/Sponsor: The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Disclaimer: None of the views expressed in this manuscript necessarily reflect the views of the American Academy of Dermatology or the Task Force.

Disclaimer: Dr Adamson is Associate Editor and Web Editor of *JAMA Dermatology* but was not involved in any of the decisions regarding review of the manuscript or its acceptance.

REFERENCES

1. Chen ST, Geller AC, Tsao H. Update on the epidemiology of melanoma. *Curr Dermatol Rep*. 2013;2(1):24-34. doi:10.1007/s13671-012-0035-5

2. Cormier JN, Xing Y, Ding M, et al. Ethnic differences among patients with cutaneous melanoma. *Arch Intern Med*. 2006;166(17):1907-1914. doi:10.1001/archinte.166.17.1907

3. Jacobsen AA, Galvan A, Lachapelle CC, Wohl CB, Kirsner RS, Strasswimmer J. Defining the need for skin cancer prevention education in uninsured, minority, and immigrant communities. *JAMA Dermatol*. 2016;152(12):1342-1347. doi:10.1001/jamadermatol.2016.3156

4. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: II. sun exposure. *Eur J Cancer*. 2005;41(1):45-60. doi:10.1016/j.ejca.2004.10.016

5. Boniol M, Autier P, Boyle P, Gandini S. Cutaneous melanoma attributable to sunbed use: systematic review and meta-analysis. *BMJ*. 2012;345:e4757. doi:10.1136/bmj.e4757

6. Grossman DC, Curry SJ, Owens DK, et al; US Preventive Services Task Force. Behavioral counseling to prevent skin cancer: US Preventive Services Task Force recommendation statement. *JAMA*. 2018;319(11):1134-1142. doi:10.1001/jama.2018.1623

7. Agbai ON, Buster K, Sanchez M, et al. Skin cancer and photoprotection in people of color: a review and recommendations for physicians and the public. *J Am Acad Dermatol*. 2014;70(4):748-762. doi:10.1016/j.jaad.2013.11.038

8. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ*. 2009;339:b2535. doi:10.1136/bmj.b2535

9. Covidence systematic review software. Accessed November 10, 2020. https://www.covidence.org/

10. Taylor SC, Cook-Bolden F. Defining skin of color. *Cutis*. 2002;69(6):435-437.

11. Oxford Centre for Evidence-Based Medicine. Oxford Centre for Evidence-Based Medicine: levels of evidence (March 2009). Accessed June 15, 2020. https://www.cebm.ox.ac.uk/resources/levels-of-evidence/oxford-centre-for-evidence-based-medicine-levels-of-evidence-march-2009

12. Adams S, Lin J, Brown D, Shriver CD, Zhu K. Ultraviolet radiation exposure and the incidence of oral, pharyngeal and cervical cancer and melanoma: an analysis of the SEER Data. *Anticancer Res*. 2016;36(1):233-237.

13. Bae JM, Ju HJ, Lee RW, et al; Korean Society of Vitiligo. Evaluation for skin cancer and precancer in patients with vitiligo treated with long-term narrowband UV-B phototherapy. *JAMA Dermatol*. 2020;156(5):529-537. doi:10.1001/jamadermatol.2020.0218

14. Eide MJ, Weinstock MA. Association of UV index, latitude, and melanoma incidence in nonwhite populations—US Surveillance, Epidemiology, and End Results (SEER) Program, 1992 to 2001. *Arch Dermatol*. 2005;141(4):477-481. doi:10.1001/archderm.141.4.477

15. Godar DE, Subramanian M, Merrill SJ. Cutaneous malignant melanoma incidences analyzed worldwide by sex, age, and skin type over personal ultraviolet-B dose shows no role for sunburn but implies one for vitamin D_3. *Dermatoendocrinol*. 2016;9(1):e1267077. doi:10.1080/19381980.2016.1267077

16. Hu S, Ma F, Collado-Mesa F, Kirsner RS. UV radiation, latitude, and melanoma in US Hispanics and Blacks. *Arch Dermatol*. 2004;140(7):819-824. doi:10.1001/archderm.140.7.819

17. Jo SJ, Kwon HH, Choi MR, Youn JI. No evidence for increased skin cancer risk in Koreans with skin phototypes III-V treated with narrowband UVB phototherapy. *Acta Derm Venereol*. 2011;91(1):40-43. doi:10.2340/00015555-0995

18. Kim HS, Kim HJ, Hong ES, et al. The incidence and survival of melanoma and nonmelanoma skin cancer in patients with vitiligo: a nationwide population-based matched cohort study in Korea. *Br J Dermatol*. 2020;182(4):907-915. doi:10.1111/bjd.18247

19. Krishnamurthy S. The geography of non-ocular malignant melanoma in India: its association with latitude, ozone levels and UV light exposure. *Int J Cancer*. 1992;51(2):169-172. doi:10.1002/ijc.2910510202

20. Lin TL, Wu CY, Chang YT, et al. Risk of skin cancer in psoriasis patients receiving long-term narrowband ultraviolet phototherapy: results from a Taiwanese population-based cohort study. *Photodermatol Photoimmunol Photomed*. 2019;35(3):164-171. doi:10.1111/phpp.12443

21. Park SL, Le Marchand L, Wilkens LR, et al. Risk factors for malignant melanoma in White and non-White/non-African American populations: the multiethnic cohort. *Cancer Prev Res (Phila)*. 2012;5(3):423-434. doi:10.1158/1940-6207.CAPR-11-0460

22. Pennello G, Devesa S, Gail M. Association of surface ultraviolet B radiation levels with melanoma and nonmelanoma skin cancer in United States Blacks. *Cancer Epidemiol Biomarkers Prev*. 2000;9(3):291-297.

23. Rivas M, Araya MC, Caba F, Rojas E, Calaf GM. Ultraviolet light exposure influences skin cancer in association with latitude. *Oncol Rep*. 2011;25(4):1153-1159.

24. Wojcik KY, Escobedo LA, Wysong A, et al. High birth weight, early UV exposure, and melanoma risk in children, adolescents, and young adults. *Epidemiology*. 2019;30(2):278-284. doi:10.1097/EDE.0000000000000963

25. National Cancer Institute. Overview of the SEER Program. Accessed July 16, 2020. https://seer.cancer.gov/about/overview.html

26. Hearn RM, Kerr AC, Rahim KF, Ferguson J, Dawe RS. Incidence of skin cancers in 3867 patients treated with narrow-band ultraviolet B phototherapy. *Br J Dermatol*. 2008;159(4):931-935. doi:10.1111/j.1365-2133.2008.08776.x

27. Bradford PT, Goldstein AM, McMaster ML, Tucker MA. Acral lentiginous melanoma: incidence and survival patterns in the United States, 1986-2005. *Arch Dermatol*. 2009;145(4):427-434. doi:10.1001/archdermatol.2008.609