
Self-reported pigmentary phenotypes and race are significant but incomplete predictors of Fitzpatrick skin phototype in an ethnically diverse population

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Background: Fitzpatrick skin phototype (FSPT) is the most common method used to assess sunburn risk and is an independent predictor of skin cancer risk. Because of a conventional assumption that FSPT is predictable based on pigmentary phenotypes, physicians frequently estimate FSPT based on patient appearance.

Objective: We sought to determine the degree to which self-reported race and pigmentary phenotypes are predictive of FSPT in a large, ethnically diverse population.

Methods: A cross-sectional survey collected responses from 3386 individuals regarding self-reported FSPT, pigmentary phenotypes, race, age, and sex. Univariate and multivariate logistic regression analyses were performed to determine variables that significantly predict FSPT.

Results: Race, sex, skin color, eye color, and hair color are significant but weak independent predictors of FSPT ($P < .0001$). A multivariate model constructed using all independent predictors of FSPT only accurately predicted FSPT to within 1 point on the Fitzpatrick scale with 92% accuracy (weighted kappa statistic 0.53).

Limitations: Our study enriched for responses from ethnic minorities and does not fully represent the demographics of the US population.

Conclusions: Patient self-reported race and pigmentary phenotypes are inaccurate predictors of sun sensitivity as defined by FSPT. There are limitations to using patient-reported race and appearance in predicting individual sunburn risk. (J Am Acad Dermatol 2014;71:731-7.)

Key words: eye color; Fitzpatrick skin phototype; Fitzpatrick skin type; hair color; pigmentary phenotype; predictor; race; skin cancer risk; skin color; sunburn risk; suntan.

The incidence of nonmelanoma and melanoma skin cancer continues to increase in the United States and exposure to ultraviolet (UV) radiation from sunlight is one of the strongest risk factors for developing these cancers.¹ The Fitzpatrick skin phototype (FSPT) classification

Abbreviations used:

CI:	confidence interval
FSPT:	Fitzpatrick skin phototype
MAE:	mean absolute error
OR:	odds ratio
UV:	ultraviolet

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system is the most commonly used method to assess sunburn and suntan risk by evaluating patient-reported sun sensitivity. In 1975, Fitzpatrick first described sun-reactive skin types I through IV to classify persons with white skin, and later modified it to include types V and VI for persons with brown and black skin.² Over time, this system has evolved to classify an individual's self-reported tendency to burn or tan after moderate sun exposure based on a scale of 6 skin types (Table 1).^{2,3} A lower FSPT corresponds to skin that burns easily and tans poorly, and a higher skin phototype indicates skin that burns rarely and tans profusely. Clinically, FSPT is commonly used to predict skin cancer risk, guide sun-protection advice, and estimate the initial minimal erythema dose for UVB, psoralen plus UVA, and laser treatments.⁴⁻¹⁰ Evidence shows that FSPT is a significant and stronger predictor of skin cancer risk than pigmentary phenotypes such as hair, eye, and skin color.⁹⁻¹¹

FSPT is strictly defined as the patient self-report of their sun reactivity after moderate UV exposure.^{2,3} However, physicians commonly predict FSPT based on race and pigmentary phenotypes, leading to the increasing trend for physicians to estimate sunburn and skin cancer risk based on visual inspection of patient appearance, a method known as physician-diagnosed skin phototype. Given that FSPT is independently associated with skin cancer risk and the common assumption that race and pigmentary phenotypes predict FSPT, it is clinically important to investigate this relationship in an ethnically diverse population. We hypothesize that there is a phenotypically unmeasurable component of race that influences FSPT beyond its relationship with pigmentary phenotypes. Ultimately, the goal is to improve our understanding about the determination of skin cancer risk in nonwhite ethnic minorities.

METHODS

Questionnaire design and study population

A 6-month cross-sectional survey study collected Internet and paper responses from 3386 individuals regarding age, sex, self-reported FSPT, eye color, hair color, constitutive skin color determined from the inside of the wrist, and race/ethnicity. FSPT was determined based on each participant's self-reported

response to the question "How does your skin react if you go outside without sunscreen for half an hour?" (Table 1). There was no physician assessment of skin phototype for study participants. Constitutive skin color was measured by showing participants a color schematic and asking them to select the color that matched closest to the color on their inside wrist (Fig 1).

An electronic link to the survey was distributed using social media sites (Facebook, Twitter) and was open to response from all over the United States. To enrich for nonwhite participants, we targeted minority group pages on these social media World Wide Web sites. Chain-referral sampling (recruitment by participants among their acquaintances) was used to further maximize participant responses. In

addition, English and Spanish paper versions of the survey were distributed during community events, including church gatherings; community lectures; and seminars at University of California at San Francisco Medical Center. We initially categorized Hispanic/Latino as an ethnicity rather than a race. However, in our pilot study, Latinos frequently selected "other" in response to the race question. Therefore, we included Latino as an answer option under race. Individuals younger than 18 years were excluded from the study. Study data were collected and managed using Research Electronic Data Capture tools at University of California at San Francisco, a secure World Wide Web-based application designed to support data capture for research studies. This study did not collect any protected health information, was performed in accordance with the Declaration of Helsinki, and was self-certified in accordance with the University of California at San Francisco Committee on Human Research.

Statistical analysis

Descriptive statistics were used to summarize overall characteristics of the study population. We used univariate analysis to identify significant single predictor variables of FSPT. The predictor variables assessed include age, sex, race, eye color, hair color, and skin color. Ordered logistic regression analysis was applied to identify variables that were significant univariate predictors of FSPT. We subsequently constructed a multivariate model

CAPSULE SUMMARY

- Fitzpatrick skin phototype is a patient-reported measure of sunburn risk and a significant predictor of skin cancer risk.
- Self-reported race and pigmentary phenotypes are inaccurate predictors of Fitzpatrick skin phototype.
- There are limitations to using self-reported race and appearance in predicting sunburn risk, as measured by the original Fitzpatrick system.

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