



# HHS Public Access

Author manuscript

*Int J Behav Med.* Author manuscript; available in PMC 2023 February 01.

Published in final edited form as:

*Int J Behav Med.* 2022 February ; 29(1): 25–35. doi:10.1007/s12529-021-09993-x.

## Acculturation, Sun Tanning Behavior, and Tanning Attitudes Among Asian College Students in the Northeastern USA

Jennifer M. Bowers<sup>1,2</sup>, Jada G. Hamilton<sup>2</sup>, Yelena P. Wu<sup>3</sup>, Anne Moyer<sup>1</sup>, Jennifer L. Hay<sup>2</sup>

<sup>1</sup>Department of Psychology, Stony Brook University, 100 Nichols Road, Stony Brook, NY 11794-2500, USA

<sup>2</sup>Department of Psychiatry & Behavioral Sciences, Memorial Sloan Kettering Cancer Center, New York, NY 10022, USA

<sup>3</sup>Department of Dermatology, University of Utah, Salt Lake City, UT 84132, USA

### Abstract

**Background**—College students participate in high levels of tanning, a skin cancer risk behavior due to ultraviolet radiation exposure, yet little is known about Asian college students' behavior. This study examined the relationship between tanning attitudes, acculturation to the USA (cultural assimilation), and tanning behavior.

**Method**—An online survey was used to recruit 211 Asian college students in the northeastern USA (47.4% born outside of the USA) to respond to questions about recent tanning behavior, sun protection strategies, attitudes about tanning, and acculturation to the USA.

**Results**—Attitudes about tanning, particularly desire for a darker skin tone and social norms, along with acculturation to the USA, were predictive of intentional tanning. The sample reported high levels of sun protection, which was associated with low acculturation.

**Conclusion**—The significant role of acculturation in this study indicates that it may be a useful factor to include in future tanning intervention studies of relevant populations.

### Keywords

Acculturation; Skin cancer; Primary prevention; Sunscreen; Tanning

### Introduction

Skin cancers are the most common cancers worldwide [1]. More than 9000 Americans died from melanoma in 2018 [2], and the incidence is rising [3]. The annual economic cost of

---

Jennifer M. Bowers, jennifer.bowers@stonybrook.edu.

Declarations

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

**Conflict of Interest** The authors declare no competing interests.

treating non-melanoma skin cancers in the USA is approximately \$5 billion [4]. Ultraviolet radiation (UVR) exposure, delivered through outdoor sun exposure or via artificial sources such as tanning beds, is the predominant risk factor for skin cancers and is largely modifiable through behavior change [1]. Sun protection strategies are recommended for reducing outdoor UVR exposure [5].

Most skin cancer risk reduction efforts have targeted non-Hispanic Whites, given that lighter skin, hair, and eyes are established skin cancer risk factors [6, 7]. However, in the USA, skin cancer represents 2–4% of all cancers among Asians, which is third highest to non-Hispanic Whites and Hispanics [8–10], and sunburn, an important risk factor for the development of skin cancers [11], is reported among 11–19% of Asian Americans [12–14]. The incidence of skin cancer has been rising in several Asian countries [15–18]. Additionally, skin cancers in non-Whites, including Asians, are often diagnosed at later stages, leading to poorer prognoses and higher rates of mortality compared to Whites [8, 19–22]. A better understanding of skin cancer risk behaviors in Asians will improve primary prevention of skin cancers in this population.

Cultural beliefs about the importance of skin color may be an important determinant of skin cancer risk behaviors among individuals from Asian backgrounds. Pale skin has historically been a standard of beauty in Asia, dating to ancient times, and in many societies today, white skin represents beauty or wealth [23]. Some Asians report a cultural preference for lighter skin [24, 25], which may lead them to avoid tanning and practice sun protection. Studies find that women raised in East Asian countries living in the USA express a desire for pale skin and activities out of the sun [25, 26]. In contrast, many Westerners, including Whites [27, 28], and Chinese adoptees [26], may prize tanned skin, which can motivate skin cancer risk behaviors [29, 30]. A recent systematic review finds that college students in the USA report particularly high levels of intentional tanning and low levels of sun protection; however, students of color are highly under-represented among these study samples [31]. Unintentional tanning, as well as sunburn, may occur accidentally or incidentally as a result of being in the sun during outdoor activities [13]. Although little research exists on unintentional tanning, we hypothesize that culture may influence one's desire to protect the skin and avoid the sun.

Psychosocial attitudes and body image concerns motivate tanning. An improved appearance [31, 32] and achieving a darker skin tone [28] are commonly reported motives for and predictors of tanning [27]. The intent to tan in the future also predicts a large amount of variance in tanning behavior [33]. Social norms that tanning is acceptable or valued among peers, family, and the media are also strong tanning motives, particularly in young people [34–36]. However, acculturation is an additional psychosocial variable of potential importance to skin cancer risk behavior.

Acculturation to the USA may diminish preference toward lighter skin among some Asian people. The definition of acculturation advanced by Graves (1967) and Redfield, Linton, and Herskovits (1936) is as follows: changes experienced by individuals as a result of contact with other cultures [37, 38]. Theoretically, the process is affected by ecological factors,

including the similarity between the two cultures and individuals' coping with acculturative stressors [39, 40]. This occurs in the context of social, institutional, and familial factors [39].

Health behavior may be strongly influenced by acculturation. For example, acculturation is a factor involved in obesity among migrants to high-income countries [41], acculturation appears to have a harmful effect on smoking behavior for Asian women and adolescents and a protective effect for Asian men [42], and acculturation is associated with alcohol consumption among Asian Americans [43]. Little is known about skin cancer risk behaviors among Asian Americans, such as outdoor tanning, and how these behaviors might differ based on the level of acculturation. In Latinos who have moved to the USA [44–46], as well as young Asian Australians [47, 48], acculturation is associated with increased skin cancer risk behaviors. The adoption of US culture by Asian American adults in California was associated with more positive attitudes toward sun exposure, as well as indoor and outdoor tanning [49]. Interventions to address skin cancer risk behaviors in Asian Americans may consider the role of acculturation in understanding tanning and sun protection behavior norms. The present study included Asian American students as well as Asian international students, or any person who identified their race as Asian.

The aims of the present study are (1) to determine if attitudes toward tanning are associated with tanning behaviors among Asian-identifying college students in the USA and (2) to determine whether acculturation to the USA may moderate the relationship between psychosocial attitudes and tanning. We hypothesize that among those who are highly acculturated to the US mainstream culture, there will be a more positive association between attitudes toward tanning and tanning behavior.

## Method

### Participants

Students at a public state university in the northeastern USA participated in an IRB-approved survey-based study using a secure online research software tool during the spring of 2018. Students were eligible if they were at least 18 years old and identified as Asian when signing up for the subject pool.

### Data Collection

Participants were provided with one-time access to the study website directly from the subject pool website and received course credit as compensation. The study began after participants indicated their consent.

### Measures

**Tanning Behaviors**—Three types of recent tanning behaviors were assessed [50, 51]: unintentional outdoor tanning (“when spending time outside, how often you ever ended up with a tan, even if you didn’t try to get one?”), intentional outdoor tanning (“how often have you spent time in the sun in order to get a tan?”), and indoor tanning (“how often have you used a tanning bed or booth with tanning lamps?”) over the past 12 months. Each of the three types of tanning were assessed using a Likert-type 5-point scale for which 1 represents

*never*, 2 represents *rarely*, 3 represents *sometimes*, 4 represents *often*, and 5 represents *always*. Intentional tanning items have been used widely with college student populations, whereas the unintentional tanning item was developed de novo.

**Sun Protection Behaviors**—We assessed one’s typical use of sun protection on a warm sunny day [51] including sunscreen, protective clothing, hats, shade seeking, sunglasses, and parasols. For each behavior, a Likert-type 5-point scale was used, for which 1 represents *never*, 2 represents *rarely*, 3 represents *sometimes*, 4 represents *often*, and 5 represents *always*. The six items were averaged to create a single, continuous sun protection behavior scale (1–5).

**Motivation to Avoid Tanning**—An 11-point scale to measure motivation to avoid a risky health behavior was adapted [52] to gauge behavioral intent and willingness to tan in the future, ranging from 0, representing *definitely not*, to 11, representing *definitely*, in response to three items: “I could avoid tanning,” “It is important for me to avoid tanning,” and “I am trying to avoid tanning.” The scale was internally consistent in our sample (Cronbach’s alpha = 0.76).

**Appearance Reasons to Tan**—The Appearance Reasons to Tan measure [53] was used to assess appearance motivations for tanning. Participants responded, on a scale of 1 (*definitely disagree*) to 5 (*definitely agree*), to nine items, such as “The tanner I am, the more attractive I feel.” This measure was highly internally consistent in our sample (Cronbach’s alpha = 0.95).

**Desired Skin Tone**—A revised Skin Tone Rating Scale [28] was administered to assess satisfaction with skin tone. Participants rated their current and ideal skin tones based on a series of male and female images of individuals with skin tones ranging from 1 (palest) to 12 (darkest). Desired skin tone was calculated by subtracting the current skin tone from the ideal skin tone [28]. The resulting desired skin tone scores could range from – 11 to 11, with negative scores indicating a desire for paler skin tone and positive scores indicating a desire for a darker skin tone.

**Social Norms**—A 6-item measure of social norms [33] assessed participants’ perception of their mother’s, father’s, and friends’ attitudes toward their intentional outdoor and indoor tanning. Items assessed the social norms of the “mother,” “father,” and “friends” for each tanning behavior and were answered on a scale ranging from 1 (*strongly think I should not*) to 7 (*strongly think I should*). Participants could indicate if a relationship did not apply to them. We found high internal consistency within and across tanning types (Cronbach’s alpha = 0.82). Therefore, the 6 items were summed and averaged.

**Skin Type and Sunburn**—Skin type was assessed using five Fitzpatrick phenotype items [54]. Each item was coded dichotomously as fair type (e.g., skin burns easily) or not. Items were summed to create a single, continuous skin type scale, ranging from 0 to 5. The number of sunburns experienced in the past 12 months was assessed using the question, “In the past 12 months how many times did you have a red OR painful sunburn that lasted a day or more?” with response six ordinal options ranging from *0 sunburns* to *5 or more sunburns*.

**Acculturation**—Acculturation to the USA was measured using the original form Suinn-Lew Asian Self Identity Acculturation scale (SL-ASIA) [55], which consists of 21 items assessing acculturation in Asian individuals on a 5-point Likert-type scale where 1 represents low acculturation and 5 represents high acculturation. An example item is, “Do you participate in Asian occasions, holidays, traditions, etc.?” To compute individuals’ scores, the 21 items were averaged. This measure had high internal consistency in our sample (Cronbach’s alpha = 0.89). It was entered into models as a continuous variable.

**Demographics**—Age, gender, race, and country of family origin (ethnicity) were assessed.

## Analysis

For aim 1, Pearson’s correlations were used to determine if psychosocial attitudes toward tanning were associated with tanning or sun protection behaviors among Asian-identifying college students in the USA. Chi-square tests were also used to determine if desired skin tone categories were associated with tanning or sun protection. For aim 2, Pearson’s correlations were used to test the relationship between psychosocial attitudes and acculturation and between acculturation and tanning or sun protection behaviors. To test for a moderating effect of acculturation on relationships between attitudes and tanning or sun protection behaviors, twelve multivariate linear regression analyses were run, for each of the four attitudes and their interactions with acculturation, on unintentional tanning, intentional tanning, and sun protection. Regressions were run separately to focus on the discrete relationships of each of the psychosocial attitudes with acculturation on the outcomes and because of collinearity between all the attitude variables. Gender (dichotomously coded male and female) and skin type were included as covariates. Ethnicity was not included as a moderator due to a need for a larger sub-group sample size to achieve adequate power. All variables in the analysis aside from gender were continuous.

## Results

Sample demographics and characteristics appear in Table 1 ( $N = 211$ ). No significant differences were detected between Asian ethnic groups across tanning and sun protection behaviors (see Table 2). Overall, unintentional tanning was commonly reported, with 72% reporting sometimes, often, or always tanning unintentionally in the past year. Intentional outdoor tanning was less common (15.2% reporting sometimes, often, or always) but still existent in the sample. Only 3 participants (1.4%) reported using indoor tanning in the past year; therefore, further analyses of indoor tanning were not conducted. Sun protection behaviors were common ( $M = 2.8$ ,  $SD = 0.6$ ), with 62% reporting often or always using two or more methods of sun protection when out on a sunny day and 87% reporting one or more.

Frequencies and means for attitudes toward tanning and acculturation are reported in Table 3. Desired skin tone averaged a score near 0; specifically, 42% desired a lighter skin tone, 35% were satisfied with their skin tone (score of 0), and 23% desired a tanner skin tone. Motivation to avoid tanning was generally high, appearance reasons to tan were not endorsed highly by the majority, and nearly all reported low social normative approval for

tanning. Acculturation was normally distributed in the sample ( $M = 2.92$ ,  $SD = 0.56$ , median = 2.95).

### **Aim 1: Relationships Between Tanning Behavior and Attitudes**

Among the four psychosocial attitudes assessed, recent unintentional tanning was only associated with decreased motivation to avoid tanning ( $r = -0.14$ ,  $p < 0.05$ ). Recent intentional tanning was also negatively associated with motivation to avoid tanning ( $r = -0.38$ ,  $p < 0.01$ ). A desire for a darker skin tone ( $r = 0.42$ ), social norms in support of tanning ( $r = 0.50$ ), and endorsing appearance reasons to tan ( $r = 0.55$ ) were each significantly, positively related to increased reported frequency of intentional outdoor tanning ( $ps < 0.01$ ). Sun protection was only associated with the motivation to avoid tanning ( $r = 0.26$ ,  $p < 0.01$ ). See Table 4 for the full correlation matrix.

Among those reporting recent intentional tanning (sometimes, often, always), more than half (56.3%) reported desiring a darker skin tone, compared to 21.9% who reported desiring a lighter skin tone and 21.9% who reported desiring no change in skin tone; this difference was significantly different according to a Pearson chi-square test,  $\chi^2 = 24.20$ ,  $p < 0.01$ . Among those reporting recent unintentional tanning (sometimes, often, always), 42.1% reported desiring a lighter skin tone, 34.2% reported desiring no change in skin tone, and 23.7% reported desiring a darker skin tone; this difference was not significantly different according to a Pearson chi-square test,  $\chi^2 = 0.33$ ,  $p = 0.85$ .

### **Aim 2: Effects of Acculturation and Psychosocial Attitudes on Tanning**

Pearson's correlations revealed univariate relationships between higher acculturation to the USA and a desire for a darker skin tone ( $r = 0.16$ ,  $p < 0.05$ ) and between higher acculturation and decreased motivation to avoid tanning ( $r = -0.20$ ,  $p < 0.01$ ). No significant direct relationships existed between acculturation and unintentional tanning ( $r = 0.10$ ,  $p = 0.07$ ) nor intentional tanning ( $r = 0.08$ ,  $p = 0.14$ ). Sun protection was significantly correlated with lower acculturation ( $r = -0.15$ ,  $p < 0.05$ ).

Multivariate linear regression results are reported in Table 5. For the unintentional tanning outcome, there were no significant effects of acculturation, psychosocial attitudes (desired skin tone, motivation to avoid tanning, social norms, or appearance reasons to tan), or their interactions.

Several factors were statistically significant among the models for the intentional outdoor tanning outcome. For the desired skin tone model, main effects were significant, such that those desiring a darker skin tone ( $p < 0.01$ ) and those with higher acculturation ( $p < 0.01$ ) reported an increased frequency of recent intentional outdoor tanning. For the motivation to avoid tanning model, no factors were significant. For the social norms model, a main effect of social norms ( $p < 0.01$ ), a main effect of acculturation ( $p < 0.01$ ), and an interaction between social norms and acculturation ( $p < 0.01$ ) were found, such that those reporting social norms with lower approval for tanning and with higher acculturation reported an increased frequency of recent intentional outdoor tanning (see Fig. 1). For the appearance reasons to tan model, only a main effect of appearance reasons was significant ( $p < 0.01$ ).

such that those endorsing more appearance reasons to tan reported a higher frequency of recent intentional outdoor tanning.

Finally, sun protection was examined as an outcome using multivariate linear regressions. For the desired skin tone model, there was a significant main effect of acculturation ( $p < 0.05$ ) such that those who reported higher acculturation reported a lower frequency of sun protection, as well as an interaction ( $p < 0.01$ ), such that those desiring a lighter skin tone and with lower acculturation reported a higher frequency of sun protection (see Fig. 2). For the motivation to avoid tanning, social norms, and appearance reasons to tan models, no factors were significant for the outcome of sun protection.

## Discussion

Our findings demonstrate that among Asian American college students, recent unintentional outdoor tanning and sunburns are common, and intentional tanning and sun protection are related to acculturation. Results highlight skin cancer risk in this understudied group [31]. About one-third endorsed appearance reasons for tanning and about a quarter desired a skin tone darker than their own. Yet nearly 9 out of 10 reported regularly using at least one method of sun protection. Psychosocial attitudes about tanning and acculturation to mainstream US culture were together predictive of intentional tanning and use of sun protection; sun protection was also directly related to lower acculturation.

It may be a common misconception that UVR damage is rare among Asian people, yet over one-third of this study sample reported experiencing a sunburn in the past year and nearly all reported that their skin had the ability to tan. A majority reported unintentionally tanning in the past year, and some reported intentionally tanning outdoors. These findings indicate that sun damage is not only possible among Asian college students but also common and should be examined further. Broader samples of college students typically report highly risky levels of sunburn and tanning; for example, one study sample similar in geography and size reported nearly two-thirds with a sunburn in the past year and about half having suntanned [56]. In comparison, risk behaviors in the present sample appear moderate. The nearly universal use of some sun protection reported in the present study is unusual in samples of college students; typically, less than one-third report using sunscreen when out in the sun [56, 57]. In our study of Asian American students, over 50% reported wearing a shirt with sleeves to protect from the sun often or always, compared to 5% among a broader sample of northeastern college students [56]. This high level of sun protection alongside high levels of unintentional tanning may indicate that sun protection is very acceptable to this sample, but sometimes its use is imperfect and still leads to an unintentional tan. More education about sun exposure and effective protection may be necessary. The role of culture in the use of sun protection should be explored further.

Acculturation to the USA was significantly related to recent intentional outdoor tanning behavior. However, this relationship was not a direct one, as acculturation was only significantly associated with intentional outdoor tanning in a model that also accounted for covariates (gender and skin type) and desired skin tone, and also in a model that accounted for covariates and social norms. Those who reported social norms unapproving of tanning

reported tanning behavior more frequently when they were more highly acculturated. Given the strong importance of desired skin tone and social norms in tanning [28, 32, 35, 36], accounting for these factors in the models demonstrates that acculturation is a unique and important factor for intentional tanning among Asian identifying US college students. Considering that tanning behavior was reported more frequently among acculturated students perceiving low social normative approval by friends and family, this factor may not affect sun-related behavior to the same extent that popular culture or media does.

Unintentional tanning did not relate to acculturation as predicted; this behavior may be more related to skin type, whereas intentional tanning is more related to social behaviors and college student culture in the USA. Finally, a direct relationship was found between higher acculturation and less sun protection, and this relationship remained significant when accounting for desired skin tone, gender, and skin type. Those who desired a lighter skin tone and were less acculturated to the USA had the highest levels of sun protection. The directionality of results, such that higher acculturation to the USA is associated with riskier sun behaviors, is also found among studies of Hispanic and Latino adults [44, 45]. Thus, Asian college students appear to be distinguished by their generally high sun protection behaviors, which are more likely to be reported by with those who are less acculturated to the USA.

Desiring a darker skin tone was significantly associated with intentional outdoor tanning (with and without controlling for covariates), and more than half who reported intentional outdoor tanning desired a darker skin tone than their own. Desiring a darker skin tone (23% of the sample) was also significantly associated with higher acculturation. About 42% of participants reported desiring a lighter skin tone than their own, which may relate to culture and beauty [24, 25]. In a national sample of Australian adolescents that utilized (and created) the same scale, only about 8% perceived their ideal skin tone to be lighter, and about 56% desired a darker skin tone [28]. Variables that measure such appearance preferences should be included in future studies to capture this aspect of acculturation.

### Study Strengths

There are several strengths to this study. The SL-ASIA scale is reliable and well-validated and the most commonly used scale for assessing acculturation among Asians [55, 58]. It was used with a diverse sample as recommended by its authors; sixteen countries of origin were represented in the sample, and participants reported a wide range of acculturation levels as represented by questions that inquired about such areas of life as cultural preferences (e.g., movies), social behaviors, and self-identity. Accounting for common covariates of tanning behavior, such as skin type, gender, and psychosocial attitudes while studying acculturation is a strength of this study as well. Few other studies have accounted for such a wide range of covariates while making conclusions about the role of acculturation; one known study with a young Australian sample that did so also found that desired skin tone and acculturation together predicted outdoor tanning [48].



## Study Limitations

There were limitations to this study and ways in which next steps can improve our knowledge in this area, including its cross-sectional design, which did not allow for tests of mediation. All participants in this study were college students; therefore, age and education may limit generalizability. The location of the college, the east coast of the USA, likely led to a sample that is less representative of Asian Americans than a nationwide sample would have been; sun-related behaviors may differ among those on the east coast compared to other parts of the country as well. Future studies may also consider larger samples to inferentially analyze sub-groups by ethnicity; it is important to consider distinctive identities within the identity of Asian. Using dictionary definitions of “parasol” and “umbrella” led to the decision to use the word “parasol” in the sun protection measure; however, this may have primed participants to think about sun protection differently.

Finally, although the original form SL-ASIA used in this study is a reliable scale and widely utilized for assessing acculturation [55], it adopts a primarily unidimensional view of acculturation due to the measurement’s linear format. The longer, revised version of the SL-ASIA, or another acculturation scale developed with a multidimensional approach, would have enhanced the information gleaned from the pre- sent study. A further limitation is that the original SL-ASIA only measures behaviors and identity, and not values.

## Future Directions

In general, future skin cancer prevention studies should include more efforts to recruit Asian Americans. Unintentional tanning should be considered an outcome variable in all future interventions of college student tanning. Appearance-related variables should also be included in order to better understand and predict tanning behavior and perhaps to motivate reduced tanning through appearance-based appeals to quit tanning [59]. Finally, the association between acculturation and desired skin tone among these Asian participants, and the association of both with tanning behavior, indicates a need to further investigate and consider the role of American culture in tanning attitudes and behaviors among Asian Americans.

## Conclusions

This study found an effect of acculturation to the USA, along with desired skin tone, and social norms, on intentional outdoor tanning behavior among Asian college students. Most participants in the study reported unintentional tanning in the past year, many reported recent sunburns, few reported intentionally tanning outdoors, and even fewer reported indoor tanning. Most utilized sun protection and doing so was associated with lower US acculturation. Knowledge about the moderating role of acculturation on the relationship between social norms and tanning behavior may be useful for tanning intervention studies that attempt to target social factors, including cultural and interpersonal motivations, for reducing tanning in diverse populations. As Asian populations rise in the USA, and with tanning and sunburning prevalent among Americans, there is a strong need to include Asian Americans in future skin cancer prevention research.

## Acknowledgements

We acknowledge Yuelin Li, PhD, and Elizabeth Schofield, MPH, for their useful input on statistical approach and Marci Lobel, PhD, for facilitating data collection.

## Funding

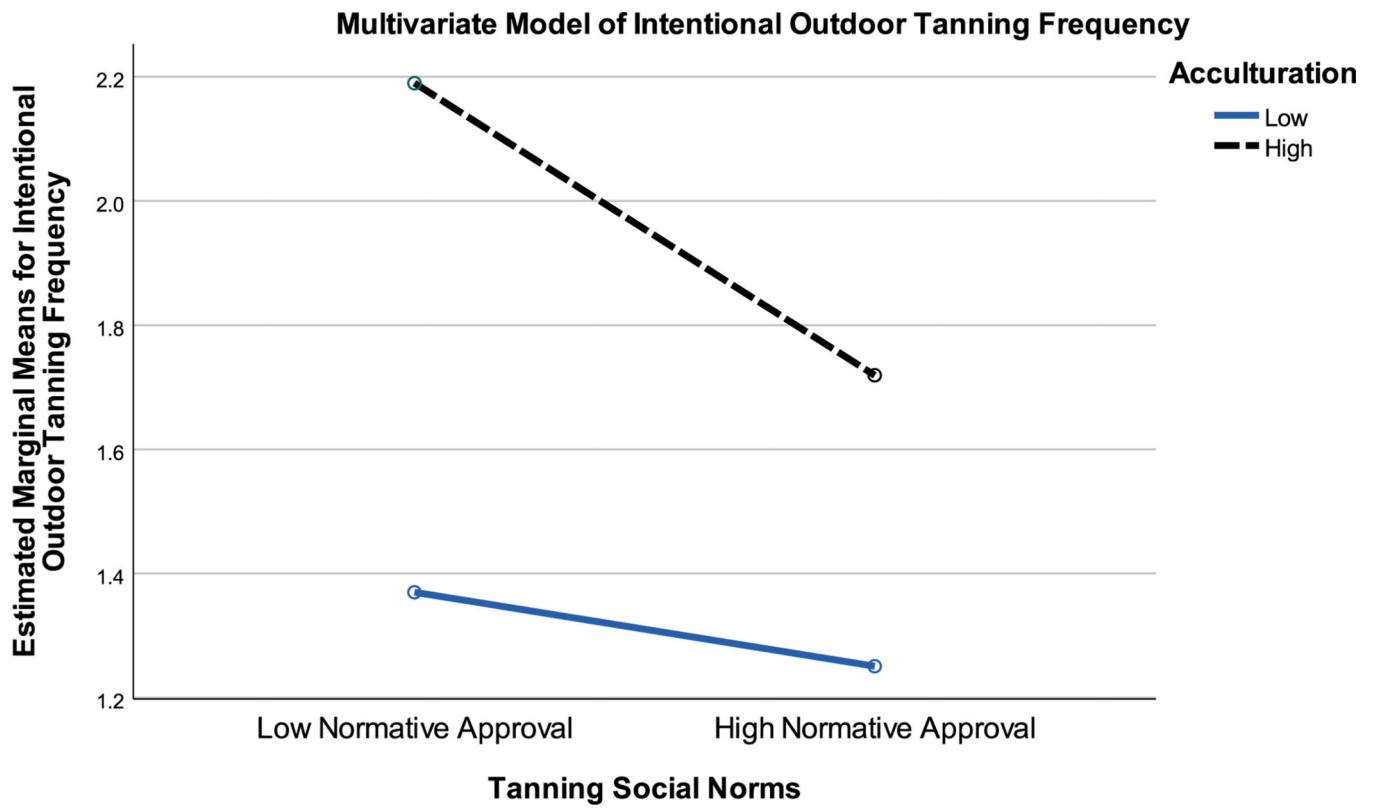
This work was supported by the National Cancer Institute, Grant Numbers T32 CA009461 and P30 CA008748.

## References

1. WHO. The known health effects of UV. 2018. Available from: [www.who.int/uv/faq/uvhealthfac/en/](http://www.who.int/uv/faq/uvhealthfac/en/).
2. ACS. Cancer facts and figures. 2018. Available from: <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2018/cancer-facts-and-figures-2018.pdf>.
3. Noone A, Howlader N, Krapcho M, Miller D, Brest A, Yu M, et al. SEER cancer statistics review, 1975–2015. National Cancer Institute. 2018.
4. Guy GP, Machlin SR, Ekwueme DU, Yabroff KR. Prevalence and costs of skin cancer treatment in the U.S., 2002–2006 and 2007–2011. *Am J Prev Med*. 2015;48(2):183–7. [PubMed: 25442229]
5. CDC. Skin cancer 2017. Available from: <http://www.cdc.gov/cancer/skin/>.
6. Gandini S, Sera F, Cattaruzza MS, Pasquini P, Zanetti R, Masini C, et al. Meta-analysis of risk factors for cutaneous melanoma: III. Family history, actinic damage and phenotypic factors. *Eur J Cancer (Oxford, England : 1990)*. 2005;41(14):2040–59.
7. Bataille V, de Vries E. Melanoma—part 1: epidemiology, risk factors, and prevention. *BMJ (Clinical research ed)*. 2008;337:a2249.
8. Gloster HM Jr., Neal K. Skin cancer in skin of color. *J Am Acad Dermatol*. 2006;55(5):741–60; quiz 61–4. [PubMed: 17052479]
9. Kim GK, Del Rosso JQ, Bellew S. Skin cancer in Asians: part 1: nonmelanoma skin cancer. *J Clin Aesthet Dermatol*. 2009;2(8):39–42.
10. Bradford PT. Skin cancer in skin of color. *Dermatology nursing / Dermatology Nurses' Association*. 2009;21(4):170–8.
11. Brash DE, Ziegler A, Jonason AS, Simon JA, Kunal S, Leffell DJ. Sunlight and sunburn in human skin cancer: p53, apoptosis, and tumor promotion. *J Invest Dermatol Symp Proc*. 1996;1(2):136–42.
12. Saraiya M, Balluz L, XJ Wen M, Joseph D. Sunburn prevalence among adults – United States, 1999, 2002, and 2004. *Morb Mortal Wkly Rep*. 2007;56:524–528.
13. McLeod GFH, Reeder AI, Gray AR, McGee R. Unintended sunburn: a potential target for sun protection messages. *J Skin Can*. 2017;2017:6902942.
14. Dusza SW, Halpern AC, Satagopan JM, Oliveria SA, Weinstock MA, Scope A, et al. Prospective study of sunburn and sun behavior patterns during adolescence. *Pediatrics*. 2012;129(2):309–17. [PubMed: 22271688]
15. Ishihara K, Saida T, Otsuka F, Yamazaki N. Statistical profiles of malignant melanoma and other skin cancers in Japan: 2007 update. *Int J Clin Oncol*. 2008;13(1):33–41. [PubMed: 18307017]
16. Ohtsuka H, Nagamatsu S. Changing trends in the number of deaths from nonmelanoma skin cancer in Japan, 1955–2000. *Dermatology (Basel, Switzerland)*. 2005;210(3):206–10.
17. Koh D, Wang H, Lee J, Chia KS, Lee HP, Goh CL. Basal cell carcinoma, squamous cell carcinoma and melanoma of the skin: analysis of the Singapore Cancer Registry data 1968–97. *Br J Dermatol*. 2003;148(6):1161–6. [PubMed: 12828744]
18. Oh C-M, Cho H, Won Y-J, Kong H-J, Roh YH, Jeong K-H, et al. Nationwide trends in the incidence of melanoma and non-melanoma skin cancers from 1999 to 2014 in South Korea. *J Korean Cancer Assoc*. 2017;0(0):0.
19. Byrd-Miles K, Toombs EL, Peck GL. Skin cancer in individuals of African, Asian, Latin-American, and American-Indian descent: differences in incidence, clinical presentation, and survival compared to Caucasians. *J Drugs Dermatol: JDD*. 2007;6(1):10–6. [PubMed: 17373156]

20. Cress RD, Holly EA. Incidence of cutaneous melanoma among non-Hispanic Whites, Hispanics, Asians, and Blacks: an analysis of California Cancer Registry data, 1988–93. *Cancer causes & control : CCC*. 1997;8(2):246–52. [PubMed: 9134249]
21. Chen YJ, Wu CY, Chen JT, Shen JL, Chen CC, Wang HC. Clinicopathologic analysis of malignant melanoma in Taiwan. *J Am Acad Dermatol*. 1999;41(6):945–9. [PubMed: 10570378]
22. Collins RJ. Melanoma in the Chinese of Hong Kong. Emphasis on volar and subungual sites. *Cancer*. 1984;54(7):1482–8. [PubMed: 6467173]
23. Hunt Y, Augustson E, Rutten L, Moser R, Yaroch A. History and culture of tanning in the United States. Shedding light on indoor tanning. New York, NY, US: Springer Science + Business Media; 2012. p. 5–31.
24. Hunter M. The persistent problem of colorism: skin tone, status, and inequality. *Sociol Compass*. 2007;1(1):237–54.
25. Chen HY, Yarnal C, Chick G, Jablonski N. Egg white or sun-kissed: a cross-cultural exploration of skin color and women's leisure behavior. *Sex Roles*. 2018;78(3–4):255–71.
26. Chen H-Y, Robinson JK, Jablonski NG. A cross-cultural exploration on the psychological aspects of skin color aesthetics: implications for sun-related behavior. *Trans Behav Med*. 2019;10(1):234–43.
27. Cafri G, Thompson JK, Jacobsen PB, Hillhouse J. Investigating the role of appearance-based factors in predicting sunbathing and tanning salon use. *J Behav Med*. 2009;32(6):532–44. [PubMed: 19653089]
28. Hutchinson AD, Prichard I, Ettridge K, Wilson C. Skin tone dissatisfaction, sun exposure, and sun protection in Australian adolescents. *Int J Behav Med*. 2015;22(4):435–42. [PubMed: 25205420]
29. Hay JL, Geller AC, Schoenhammer M, Gordon M, Bishop M, Shuk E, et al. Tanning and beauty: mother and teenage daughters in discussion. *J Health Psychol*. 2016;21(7):1261–70. [PubMed: 25318997]
30. Kirk L, Greenfield S. Knowledge and attitudes of UK university students in relation to ultraviolet radiation (UVR) exposure and their sun-related behaviours: a qualitative study. *BMJ Open*. 2017;7(3):e014388.
31. Gambla WC, Fernandez AM, Gassman NR, Tan MCB, Daniel CL. College tanning behaviors, attitudes, beliefs, and intentions: a systematic review of the literature. *Prev Med*. 2017;105:77–87. [PubMed: 28867504]
32. Lazovich D, Forster J, Sorensen G, Emmons K, Stryker J, Demierre MF, et al. Characteristics associated with use or intention to use indoor tanning among adolescents. *Arch Pediatr Adolesc Med*. 2004;158(9):918–24. [PubMed: 15351760]
33. Hillhouse J, Adler CM, Drinnon J, Turrisi R. Application of Azjen's theory of planned behavior to predict sunbathing, tanning salon use, and sunscreen use intentions and behaviors. *J Behav Med*. 1997;20(4):365–78. [PubMed: 9298435]
34. Hillhouse J, Turrisi R, Cleveland MJ, Scaglione NM, Baker K, Florence LC. Theory-driven longitudinal study exploring indoor tanning initiation in teens using a person-centered approach. *Ann Behav Med*. 2016;50(1):48–57. [PubMed: 26370893]
35. Carcioppolo N, Orrego Dunleavy V, Yang Q. How do perceived descriptive norms influence indoor tanning intentions? An application of the theory of normative social behavior. *Health Commun*. 2017;32(2):230–9. [PubMed: 27230254]
36. Cokkinides V, Weinstock M, Lazovich D, Ward E, Thun M. Indoor tanning use among adolescents in the US, 1998 to 2004. *Cancer*. 2009;115(1):190–8. [PubMed: 19085965]
37. Redfield R, Linton R, Herskovits MJ. Memorandum for the study of acculturation. *Am Anthropol*. 1936;38(1):149–52.
38. Graves TD. Acculturation, access, and alcohol in a tri-ethnic community. *Am Anthropol*. 1967;69(3–4):306–21.
39. Ward C, Geeraert N. Advancing acculturation theory and research: the acculturation process in its ecological context. *Curr Opin Psychol*. 2016;8:98–104. [PubMed: 29506811]
40. Baek Choi J, Thomas M. Predictive factors of acculturation attitudes and social support among Asian immigrants in the USA. *Int J Soc Welf*. 2009;18(1):76–84.

41. Alidu L, Grunfeld EA. A systematic review of acculturation, obesity and health behaviours among migrants to high-income countries. *Psychol Health*. 2018;33(6):724–45. [PubMed: 29172700]
42. Choi S, Rankin S, Stewart A, Oka R. Effects of acculturation on smoking behavior in Asian Americans: a meta-analysis. *J Cardiovas Nurs*. 2008;23(1).
43. Lui PP, Zamboanga BL. Acculturation and alcohol use among Asian Americans: a meta-analytic review. *Psychology of addictive behaviors : J Soc Psychol Addi Behav*. 2018;32(2):173–86.
44. Andreeva VA, Unger JB, Yaroch AL, Cockburn MG, Baezconde-Garbanati L, Reynolds KD. Acculturation and sun-safe behaviors among US Latinos: findings from the 2005 Health Information National Trends Survey. *Am J Public Health*. 2009;99(4):734–41. [PubMed: 19150918]
45. Coups EJ, Stapleton JL, Hudson SV, Medina-Forrester A, Natale- Pereira A, Goydos JS. Sun protection and exposure behaviors among Hispanic adults in the United States: differences according to acculturation and among Hispanic subgroups. *BMC Public Health*. 2012;12:985. [PubMed: 23153104]
46. Coups EJ, Stapleton JL, Hudson SV, Medina-Forrester A, Rosenberg SA, Gordon MA, et al. Linguistic acculturation and skin cancer- related behaviors among Hispanics in the southern and western United States. *JAMA Dermatol*. 2013;149(6):679–86. [PubMed: 23752366]
47. Day AK, Wilson CJ, Hutchinson AD, Roberts RM. Sun-related behaviours among young Australians with Asian ethnic background: differences according to sociocultural norms and skin tone perceptions. *Eur J Cancer Care*. 2015;24(4):514–21.
48. Day AK, Wilson CJ, Hutchinson AD, Roberts RM. Acculturation, skin tone preferences, and tanning behaviours among young adult Asian Australians. *J Primary Prevent*. 2016;37(5):421–32.
49. Gorell E, Lee C, Munoz C, Chang AL. Adoption of Western culture by Californian Asian Americans: attitudes and practices promoting sun exposure. *Arch Dermatol*. 2009;145(5):552–6. [PubMed: 19451499]
50. Lazovich D, Stryker JE, Mayer JA, Hillhouse J, Dennis LK, Pichon L, et al. Measuring nonsolar tanning behavior: indoor and sunless tanning. *Arch Dermatol*. 2008;144(2):225–30. [PubMed: 18283180]
51. Glanz K, Yaroch AL, Dancel M, Saraiya M, Crane LA, Buller DB, et al. Measures of sun exposure and sun protection practices for behavioral and epidemiologic research. *Arch Dermatol*. 2008;144(2):217–22. [PubMed: 18283179]
52. Miller WR, Johnson WR. A natural language screening measure for motivation to change. *Addict Behav*. 2008;33(9):1177–82. [PubMed: 18558466]
53. Cafri G, Thompson JK, Roehrig M, Rojas A, Sperry S, Jacobsen PB, et al. Appearance motives to tan and not tan: evidence for validity and reliability of a new scale. *Ann Behav Med*. 2008;35(2):209–20. [PubMed: 18365298]
54. Fitzpatrick T. The validity and practicality of sun-reactive skin type I through VI. *Arch Dermatol*. 1988;124:869–71. [PubMed: 3377516]
55. Suinn RM, Ahuna C, Khoo G. The Suinn-Lew Asian Self-Identity Acculturation Scale: concurrent and factorial validation. *Educ Psychol Measur*. 1992;52:1041–6.
56. Basch CH, Cadorett V, MacLean SA, Hillyer GC, Kernan WD. Attitudes and behaviors related to sun-safety in college students. *J Community Health*. 2017;42(4):757–62. [PubMed: 28243774]
57. Mahler HIM, Kulik JA, Gibbons FX, Gerrard M, Harrell J. Effects of appearance-based intervention on sun protection intentions and self-reported behaviors. *Health Psychol*. 2003;22(2):199–209. [PubMed: 12683740]
58. Phillips CE, King C, Kivisalu TM, O'Toole SK. A reliability generalization of the Suinn-Lew Asian Self-Identity Acculturation Scale. *SAGE Open*. 2016;6(3):215824401666174.
59. Persson S, Benn Y, Dhingra K, Clark-Carter D, Owen AL, Grogan S. Appearance-based interventions to reduce UV exposure: a systematic review. *British J Health Psychol*. 2018.



**Fig. 1.** Multivariate model of intentional outdoor tanning frequency using Model 3 (from Table 5)

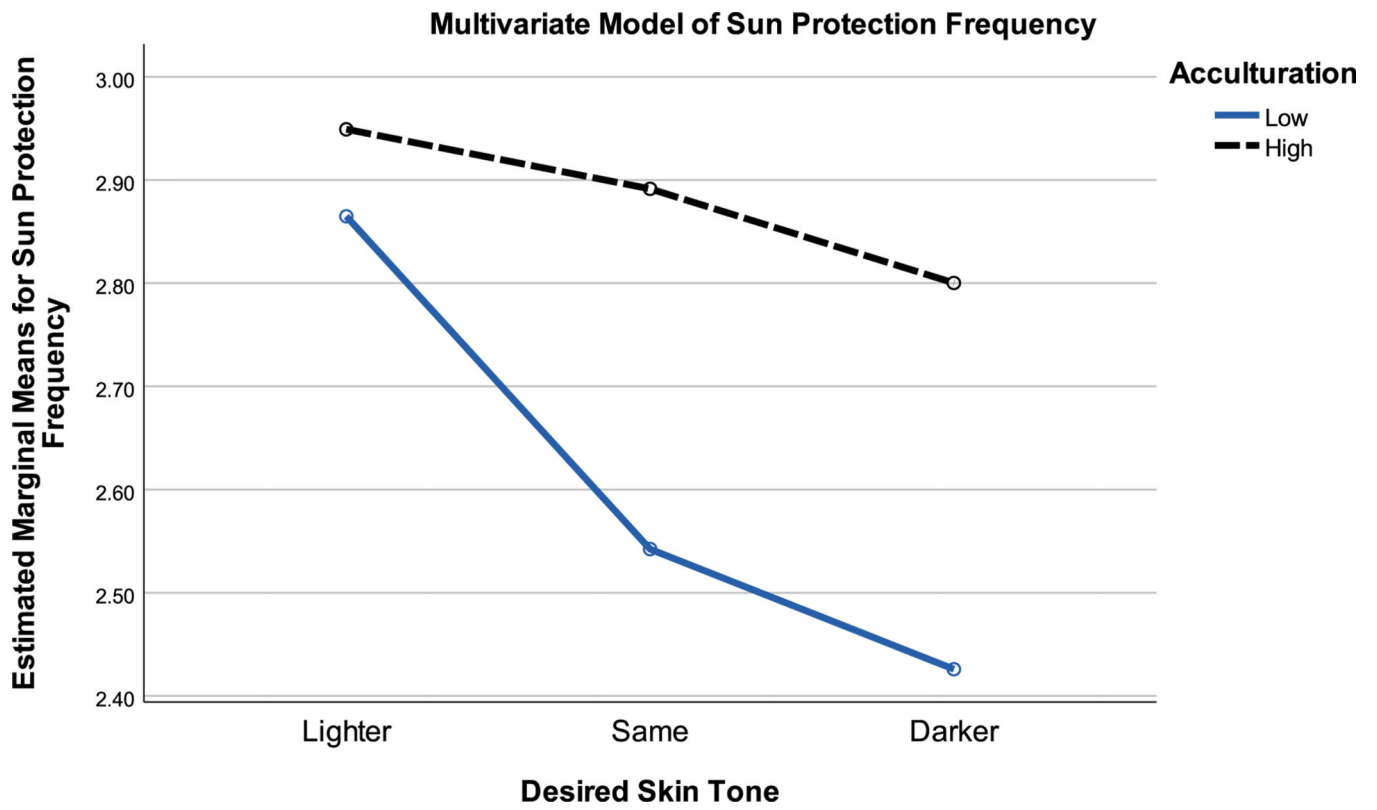


Fig. 2. Multivariate model of sun protection frequency using Model 1 (from Table 5)

**Table 1**Sample demographic characteristics ( $N=211$ )

Variables	<i>n</i> (%)
Age (years) <i>M</i> ( <i>SD</i> )	19.7 (1.4)
Median (range)	20 (18–27)
Gender	
Female	108 (51.2)
Male	72 (34.1)
Non-binary	1 (0.5)
Missing <sup>a</sup>	30 (14.2)
Ethnicity	
Chinese	105 (49.8)
Indian	35 (16.6)
Korean	21 (10.0)
Other Asians <sup>b</sup>	50 (23.6)
Nativity	
Born outside of the USA	100 (47.4)
Born in the USA	111 (52.6)
Phenotypic variables	
Hair	
Red, fair, or blonde	4 (1.9)
Brown or black	207 (98.1)
Eyes	
Blue, green, hazel	3 (1.4)
Brown or black	208 (98.6)
Freckling	
None, very few, few	207 (98.1)
Some, many, very many	4 (1.9)
Skin burns in summer	
Yes	82 (38.9)
No	129 (61.1)
Skin tans in summer	
Yes	201 (95.3)
No	10 (4.7)
Past year sunburn	
Yes	79 (37.4)
No	132 (2.6)

<sup>a</sup>A higher-than-average number of respondents did not answer the question about gender. These cases were determined to be from an error with the questionnaire software

<sup>b</sup>Other ethnicities include Bangladeshi ( $n=9$ ), Filipino ( $n=9$ ), Paki- stani ( $n=8$ ), mixed Asian descent ( $n=5$ ), Taiwanese ( $n=4$ ), Bengali ( $n=3$ ), Nepali ( $n=3$ ), Sri Lankan ( $n=2$ ), Tibetan ( $n=2$ ), Vietnamese ( $n=2$ ), Afghan ( $n=1$ ), Japanese ( $n=1$ ), and Punjabi ( $n=1$ )

**Table 2**

Behavioral outcome variables by identified ethnicity<sup>a</sup> (N, %)

	All (N = 211)	Chinese (n = 105)	Indian (n = 35)	Korean (n = 21)	Other Asians (n = 50) <sup>b</sup>
Recent unintentional tanning					
Never	14 (6.6)	7 (6.7)	2 (5.7)	1 (4.8)	4 (8.0)
Rarely	45 (21.3)	24 (22.9)	8 (22.9)	7 (33.3)	6 (12.0)
Sometimes	78 (37.0)	42 (40.0)	11 (31.4)	9 (42.9)	16 (32.0)
Often	55 (26.1)	27 (25.7)	8 (22.9)	2 (9.5)	18 (36.0)
Always	19 (9.0)	5 (4.8)	6 (17.1)	2 (9.5)	6 (12.0)
Recent intentional tanning					
Never	114 (54.0)	53 (50.5)	21 (60.0)	11 (52.4)	29 (58.0)
Rarely	65 (30.8)	35 (33.3)	11 (31.4)	6 (28.6)	13 (26.0)
Sometimes	24 (11.4)	14 (13.3)	1 (2.9)	3 (14.3)	6 (12.0)
Often	8 (3.8)	3 (2.9)	2 (5.7)	1 (4.8)	2 (4.0)
Always	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Recent indoor tanning					
Never	203 (96.2)	98 (93.3)	35 (100.0)	20 (95.2)	50 (100.0)
Rarely	5 (2.4)	4 (3.8)	0 (0.0)	1 (4.8)	0 (0.0)
Sometimes	2 (0.9)	2 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)
Often	1 (0.5)	1 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)
Always	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Sun protection <i>M</i> ( <i>SD</i> ) <sup>c</sup>	2.8(0.6)	2.8(0.6)	2.8(0.6)	2.9(0.7)	2.8(0.7)

<sup>a</sup>No group differences were determined by ANOVA or chi-square tests

<sup>b</sup>Other ethnicities include Bangladeshi (n = 9), Filipino (n = 9), Pakistani (n = 8), mixed Asian descent (n = 5), Taiwanese (n = 4), Bengali (n = 3), Nepali (n = 3), Sri Lankan (n = 2), Tibetan (n = 2), Vietnamese (n = 2), Afghan (n = 1), Japanese (n = 1), and Punjabi (n = 1)

<sup>c</sup>Sun protection was summarized by averaging the frequency of six sun protection behavior items, where 1 represents *never* and 5 represents *always*



**Table 3**Psychosocial attitudes toward tanning, acculturation ( $N = 211$ )

	<b>n, %</b>	<b>M, SD</b>
Desired skin tone		- 0.28 (1.31)
Lighter (- 11 to - 1)	89 (42.2)	
No change (0)	74 (35.1)	
Darker (1-11)	48 (22.7)	
Motivation to avoid tanning <sup>a</sup>		6.42 (2.65)
High	153 (72.5)	
Low	58 (27.5)	
Appearance reasons to tan <sup>a</sup>		1.91 (0.92)
High	66 (31.3)	
Low	145 (68.7)	
Social norms for tanning <sup>a,b</sup>		6.10 (0.93)
High approval	8 (4.2)	
Low approval	184 (95.8)	
Acculturation <sup>a</sup>		2.92 (0.56)
High	99 (46.9)	
Low	112 (3.1)	

<sup>a</sup>Categories determined by midpoints of scales<sup>b</sup>Values total 192 rather than 211 because some participants indicated a lack of relationship with specific family or friends described in the item(s)

**Table 4**

Pearson's correlations for study variables

Variable	1	2	3	4	5	6	7	8	9	10
1. Intentional tanning										
2. Unintentional tanning	0.14*									
3. Sun protection	-0.004	0.10								
4. Acculturation	0.08	0.10	-0.15*							
5. Social norms	-0.42**	0.08	0.13	0.07						
6. Appearance reasons to tan	0.55**	0.09	-0.04	0.08	-0.43**					
7. Desired skin tone	0.42**	-0.05	-0.08	0.16*	-0.25**	0.46**				
8. Motivation to avoid tanning	-0.38**	-0.14*	0.26**	-0.20**	0.26**	-0.44**	-0.31**			
9. Age	0.16*	0.09	0.06	-0.11	-0.06	0.06	-0.05	-0.13		
10. Skin type	0.02	0.27**	0.03	0.22**	0.16*	-0.10	-0.12	-0.09	-0.05	
11. Gender (M = 1, F = 2)	-0.05	-0.17*	-2.27**	0.11	-0.23**	-0.12	-0.001	-0.17*	0.07	-0.02

Missing data was handled using pairwise deletion

\*  $p < .05$ ;

\*\*  $p < .01$

**Table 5**

Multivariate linear regression analyses controlling for gender and skin type

Multivariate regression analysis ( $F^d$ )		Unintentional tanning		Intentional tanning		Sun protection	
Model <sup>b,c</sup>	Variable	F	Partial eta squared	F	Partial eta squared	F	Partial eta squared
1.	Gender	0.32	0.01	2.86	0.04	5.95*	0.09
	Skin Type	6.32*	0.09	5.62*	0.08	4.17*	0.06
	<b>Desired skin tone</b>	1.08	0.12	12.22**	0.61	1.95	0.20
	Acculturation	0.82	0.38	1.66*	0.55	1.59*	0.54
2.	Desired skin tone* acculturation	1.08	0.52	1.39	0.58	1.94**	0.66
	Gender	1.49	0.11	0.12	0.01	0.38	0.03
	Skin type	0.43	0.04	1.50	0.11	0.60	0.05
	<b>Motivation to avoid tanning</b>	0.55	0.57	1.52	0.79	0.74	0.64
3.	Acculturation	0.59	0.69	0.56	0.69	0.51	0.66
	Motivation to avoid tanning* acculturation	0.68	0.84	0.59	0.82	0.62	0.82
	Gender	5.31*	0.18	4.54*	0.15	6.74*	0.21
	Skin type	3.52	0.12	6.51*	0.21	0.75	0.03
	<b>Social norms</b>	0.67	0.36	7.83**	0.87	1.16	0.50
	Acculturation	0.65	0.53	2.75**	0.83	1.04	0.65
4.	Social norms* acculturation	0.66	0.62	2.35**	0.85	0.59	0.59
	Gender	3.00	0.84	0.19	0.01	7.53**	0.20
	Skin type	3.06	0.38	1.98	0.06	0.20	0.01
	<b>Appearance reasons to tan</b>	1.04	0.09	7.87**	0.87	0.96	0.46
	Acculturation	0.76	0.09	1.34	0.67	1.05	0.61
	Appearance reasons to tan* acculturation	1.00	0.48	1.20	0.74	1.17	0.73

<sup>d</sup> F-values with one asterisk

(<sup>ns</sup>) indicate statistical significance of  $p < .05$ ; two asterisks

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

(\*\*\*) indicate statistical significance of  $p < .01$

*b* Each model simultaneously tested for the effects of one of four psychosocial variables, acculturation, and the interaction term, for one of three outcomes, controlling for gender and skin type, for a total of twelve models

*c* Listwise deletion was used to handle missing data

*d* Bold emphasis is for the purpose of identifying the unique psychosocial variable in each model