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Author manuscript

*Pigment Cell Melanoma Res.* Author manuscript; available in PMC 2018 September 01.

Published in final edited form as:

*Pigment Cell Melanoma Res.* 2017 September ; 30(5): 488–492. doi:10.1111/pcmr.12598.

## Recognizing Latinos' Range of Skin Pigment and Phototypes to Enhance Skin Cancer Prevention

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### Summary

Latinos in the United States may have the mistaken assumption that their natural pigmentation protects them from developing skin cancer that, effectively, serves as a barrier to Latinos receiving education in primary and secondary prevention of skin cancer. Latino adults of Mexican or Puerto Rican heritage attending community health fairs in the greater Chicago area responded to a culturally informed and sensitive measure for sunburn and tan, which was previously adapted to capture skin irritation with tenderness from the sun occurring in darker skin types (n=350). By self-reported responses and spectrophotometry assessment of constitutive pigmentation, adapted Fitzpatrick skin types (FST) ranged from skin type I to IV in the Mexican-American participants and from II to V in the Puerto Rican participants. The objectively measured proportion of adapted FST II skin type was greater than commonly perceived and demonstrated that many Latinos do indeed have sun sensitive skin.

### Keywords

Latino; skin pigment; phototypes; adapted Fitzpatrick skin type

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Latino ethnicity encompasses a large group of individuals who are diverse in regard to geographical origin, genetics, race, cultural practices, and socioeconomic status (Pew 2015). Social scientists regard there to be a clear distinction between the categories of race and ethnicity, but many people and most Latinos conflate race and ethnicity (Pew 2015; Perreira

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Financial disclosures: There are no conflicts of or competing interests for any of the authors.

et al, 2014). This is evident in self-reports where about two-thirds of Latinos identify “Hispanic” as an integral part of their racial background (Pew 2015) Importantly, most skin protection prevention messages are framed to reflect skin tone (fair) and racial background (non-Hispanic white). The range of sun sensitivity in Latinos may be similar to the range in non-Hispanic whites (Galindo et al, 2007), but self-identification of one’s racial background as “Hispanic” may hinder awareness of risks presented by sun exposure, which for some Latinos is considerable. Many Latinos, especially agricultural migrant workers, work in outdoor occupations with high sun exposure (US Census Bureau, 2006), and consistently lack sun protection (Pipitone et al, 2002).

The Fitzpatrick skin phototype classification system (FST) has remained the standard assessment of sensitivity to ultraviolet radiation (UVR) exposure. Originally published in 1975, it included four categories for non-Hispanic whites (whites) based on self-reported tendency to sustain a painful sunburn and ability to tan at 24 hours and 7 days, respectively, after initial sun exposure with an implied reciprocal interdependence between the tendency to burn and the ability to tan. (Fitzpatrick, 1975) In 1988, brown and black-skinned persons were included as skin types V and VI, respectively and the description of the painful sunburn was modified to include tender sunburn. (Fitzpatrick, 1988) (Table 1) The manner in which skin types V and VI were added established a precedent for grouping all people of a similar ethnic/racial group into a single category of FST, thus, “brown” conveyed Latino and Asian ancestry, and “black” conveyed African ancestry. (Stanford et al, 1996; Park et al 1998; Pichon et al, 2010; Kelly 2016) An important concern with the FST categorization is that people with dark skin respond to UVR exposure in ways that differ from those with light skin and use different terms to describe their skin’s reaction to sun exposure, rendering the standard descriptions of tanning or burning inadequate. Focus groups of Latinos described the reaction of their skin to the sun about 24 hours after exposure as skin irritation, tenderness, or itching, that was followed by the skin getting darker, thus, the cultural adaptation of the FST was proposed (adapted FST). (Robinson et al, 2011; Eilers et al, 2013) Structured interviews in English and Spanish with adult Latinos of Mexican heritage indicated the face value of the adapted FST that included skin irritation with tenderness in sun exposed skin. (Table 1)

Sunburn sensitivity is determined by melanin density, distribution, and type in the epidermis, and can be estimated accurately with a spectrophotometer. (Amblard et al, 1982; Chan et al, 2005; Dwyer et al, 1998; Pershing et al, 2008) The melanin density of the upper inner arm, constitutive pigmentation, measured by spectrophotometry is a strong predictor of risk of skin cancer. (Dwyer et al 2002) This research aimed to validate Latinos’ self-reported responses to the adapted FST with spectrophotometric assessment of the constitutive pigmentation among urban Latinos in Chicago.

## Methods

From June 15 to September 28, 2016, a convenience sample of Latino adults attending Latino community health fairs was recruited to participate in a verbally administered survey in either English or Spanish for the self-reported response of their skin to the sun. Latino ethnicity was self-identified in each individual, along with other demographics including

age, sex, and nation of origin. Participants underwent reflectance spectrophotometry to measure the constitutive pigment of the upper inner arm. (Mexameter MX18 probe, Corage + Khazaka Electronic GmbH, Koln, Germany). Inclusion criteria included ability to speak English or Spanish, age 18 or older, self-identification as Latino, and willing to respond to a survey and have skin pigmentation assessed with a spectrophotometer. Exclusion criteria involved lack of ability to speak English or Spanish, being less than 18 years old, not identifying as Latino, and being unwilling to reply to the survey and have pigmentation assessed.

Two bilingual and bicultural research assistants, who are Mexican American, and a dermatologist (JKR) hosted a booth at fairs in three different Latino neighborhoods. Self-reported responses to questions about age, sex, cultural identity, and the nation of origin of their family were recorded. The participant was then asked to respond to the adapted FST survey. (Table 1) All participants were asked to select one of the six responses presented to the following question: If after several months of not being in the sun, you stayed outdoors for about 1 hour at noon for the first time in the summer in Chicago without sunscreen would your skin burn or get irritated and tender? Over the next 7 days would you develop a tan or would your sun-exposed skin get darker? All responses were recorded by the research assistant. A random sample of 50 bilingual participants fluent in both English and Spanish were asked if each of the terms (skin irritation with tenderness in sun exposed skin and skin becomes darker) (Robinson et al, 2011; Eilers et al, 2013) provided in the responses was understandable. (Table 1)

Three non-invasive skin pigmentation measurements with the spectrophotometer were taken from the upper inner arm in a location without nevi or hair. The three measures were averaged to obtain the constitutive pigmentation of each person, melanin index. (Robinson et al, 2016) Participants did not receive compensation. The Institutional Review Board of Northwestern University approved the study (STU00201983) and allowed verbal assent.

### Statistical Analysis

Statistical differences between the melanin indexes for each adapted FST group were analyzed via one-way analysis of variance followed by the Tukey's post hoc test. The correlation between Latino self-reported adapted FST and melanin index was assessed using the Spearman correlation coefficient. The correlation between the melanin index by FST in non-Hispanic whites and the melanin index by adapted FST in Latinos was assessed using the Spearman correlation coefficient. Statistical calculations and analyses were performed using SPSS statistical software (version 20; SPSS Inc.). A  $p < .05$  indicated statistical significance.

### Results

Among the 350 participants, 300 who identified as Mexican Americans were predominantly adapted FST II (42.3%) and III (44.0%). (Table 2) The random sample of 50 bilingual Latinos, who commented on the terms used to describe the response of the skin to the sun, was composed of 37 Mexican Americans and 13 Puerto Ricans. The participants felt the term skin irritation with tenderness was understandable, but noted difficulty separating the

descriptive terms: *easily* (FSTII and adapted FST II) from *moderately* burns or gets skin irritation with tenderness (FSTIII and adapted FST III). Several Latinas said that burn usually meant a thermal burn, such as a burn from the oven.

In this adult population, the melanin index demonstrated statistically significant differences for adapted FST I vs II, III vs IV, and IV vs V. ( $p = .01$ ). The differences in melanin index for adapted FST II vs III did not reach statistical significance, which was demonstrated in our prior report of FST in four ethnic/ racial groups. (Eilers et al 2013) The melanin index of the upper inner arm strongly correlated with self-reported adapted FST, Spearman  $\rho$ , 0.88,  $p < 0.01$ . The melanin index by skin type in this sample of Latinos correlated with the sample of previously reported non-Hispanic whites (Robinson 2016) Spearman  $\rho$ , 0.71,  $p < 0.01$ .

The primary finding of our research was that self-reported adapted FST for Latinos ranged from I–V with 42.3% of this urban, predominantly Mexican American population having adapted FST II. A secondary finding is the validation of the adapted FST with spectrophotometry assessment of constitutive pigmentation. These findings document the importance of moving beyond ethnicity in determining sun sensitivity and skin phototype, and in including individuals across ethnic backgrounds in behavioral intervention research to reduce melanoma risk.

Our community-based convenience sample of Latinos found 42% had adapted FST II. In a 1980 survey of 596 Mexican American women, the self-reported responses to the color of the skin were 13% very light brown (FST II), 21% light brown (FST III), 32% medium brown (FST IV), 25% dark brown (FST V), and 6% very dark brown (FST VI) (Arce 1980). In 2007, 513 Latino postal workers in Southern California self-reported having 10% FST II and 31% FST III without spectrophotometry assessment of constitutive pigmentation. (Galindo et al, 2007). In contrast to both the 1980 and 2007 surveys, in our study, using the adapted FST, a much greater prevalence of adapted FST II - 42% was demonstrated and constitutive pigmentation was obtained with spectrophotometry. There are several possible reasons for this difference. First, the terms, *easily* and *moderately*, used to describe burning or skin irritation with tenderness does not adequately discriminate between FST or adapted FST II and III. Relatively more people of broadly Spanish-language speaking, European background may be declaring themselves to be Latinos because of increased awareness of and pride in Latino identity. It is also possible that the self-reported adapted FST of Latinos in the Chicago area has changed because of shifts in genetic admixture toward a relatively higher percentage of European pigmentation gene variants. Another possibility is that, in the years between 1980 and 2016, the lifestyles of urban Latinos have changed, resulting in fewer people engaging in outdoor activity with high levels of sun exposure and less awareness of their skin's reaction to sunlight. During this period, Mexican-Americans in Chicago have increased the relative amount of time they spend indoors because of crime in parks and other areas which were once sites of leisure activities (Stodolska et al, 2013). Many people, who may have self-reported as FST III decades ago, may now report as adapted FST II. A final possible reason for the increase in the percentage of Latinos declaring themselves as adapted FST II may be the social stigma associated with having skin that is capable of becoming dark through sun exposure. Colorism in Latino communities is marked (Breland-Noble, 2013; Hunter, 2007; Fraga et al, 2006; Hunter, 2002) and people

responding to a survey held in a public space may have been unwilling to admit to being adapted FST III or IV.

The secondary finding is validation of the adapted FST that used survey items designed to capture skin changes from sun exposure in temperate climates. In Chicago, which is comparable in latitude to Fitzpatrick's hometown of Boston (approximately 42° N), the sun emits about 6 standard erythema dose (SED) per hour at noon in mid-May. In the southern part of the USA (approximately 24°N), the sun emits about 12 SED per hour. Latinos' response to the survey may depend upon the latitude in which they live; therefore, the adapted FST states exposure in temperate climates.

The study is not without some limitations. First, the research relies in part on self-report. Second, the convenience sample consisted primarily of Mexican-American women, which may limit the generalizability to other populations. Third, the participants may have a greater health focus or skin health focus as they chose to attend a health fair and came to a table designated as doing skin checks. Finally, it was not possible to distinguish skin irritation from photodermatoses or photosensitive drug reactions. Further research is needed in more diverse Latino populations to examine the efficacy of the adapted FST and test, re-test validation needs to be performed. The finding of a wide disparity in genetic admixture in Mexican Americans in one American metropolitan area (San Antonio) highlights the importance of extensive sampling to capture true levels of genetic and phenotypic variation, even in a relative small region (Beuten et al, 2011). Further, Latinos from Latin America and the Caribbean are even more genetically diverse than most Mexican Americans, and have darker skin (Cuevas et al, 2016; Marcheco-Teruel et al, 2014).

It is important for Latinos to be informed about the extent of natural protection afforded by their own skin pigmentation in order to make decisions about using sun protection that will influence the development of melanoma. While melanoma is primarily a disease of non-Hispanic Whites, exposure to high UVR produces melanoma in Latinos, especially those working in outdoor occupations (Rouhani et al, 2008). With increasing amounts of genetic admixture occurring especially in urban areas, there is increasing likelihood that individuals with *MC1R* polymorphisms at risk for developing melanoma will have "dark skin" because of the effects of genetic epistasis on the production of skin color phenotypes (Branicki et al, 2009; Kanetsky et al, 2006; Kanetsky et al 2010; Kennedy et al 2001; Pasquali et al, 2015). Changing the erroneous belief of physicians, including dermatologists, and Latinos that they have low or no melanoma risk may improve risk awareness, sun protection and the early detection of melanoma (Rouhani et al, 2008; Pipitone et al, 2002).

## Acknowledgments

The research assistants, Mercedes Nodal and Leonid Chavez, and biostatistician, Brittney A. Hultgren, PhD were supported by grant R01CA154908 from the National Cancer Institute (to Dr. Robinson).

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### Significance

The objective assessment of Latinos' constitutive skin pigment demonstrated that the range of pigmentation was greater than commonly perceived. Using the adapted FST and spectrophotometric assessment of melanin of the upper inner arm skin, 42% of urban adults of Mexican heritage had adapted FST II. Since people with FST I-II skin have an increased risk of developing melanoma and using sun protection can reduce the risk, sun protection by these Latinos could prevent the development of melanoma. Mistaken beliefs about pigmentary protection hinder primary and secondary prevention education of Latinos and their receptivity to public health messages.



**Table 1**

Fitzpatrick skin phototype, skin color, and adapted Fitzpatrick skin phototype

Fitzpatrick skin phototype after exposure to 45 to 60 min of noon sun in northern latitudes (20° to 45°) in early summer *	Skin color **	Adapted Fitzpatrick skin phototype ***
I Always burns, never tan (painful burn at 24 hrs and no tan at 7 d)	Pale white	Always burns, never develops a tan.
II Burn easy, then develop light tan (painful burn at 24 hrs and a light tan at 7 d)	White	Easily burns or skin irritation with tenderness in sun exposed skin, then develops a light tan or gets a bit darker when in temperate climates.
III Burn moderately, then develop light tan (slightly tender burn at 24 hrs, moderate tan at 7d)	Light brown	Moderately burns or skin irritation with tenderness in sun exposed skin, then develops a medium tan or skin becomes slightly darker in sun exposed sites when in temperate climates.
IV Burn minimally-rarely, then develop moderate tan (no burn at 24 hrs and a good tan at 7 d)	Moderate brown	Minimal burns or skin irritation with tenderness in sun exposed skin, then develops a deep tan or skin becomes darker in sun exposed sites when in temperate climates.
V Never burns, always develops dark tan	Dark brown	No skin irritation with tenderness in sun exposed skin, develops darker skin in sun exposed sites when in temperate climates.
VI Never burns, no noticeable change in appearance	Deeply pigmented dark brown to black	No skin irritation with tenderness in sun exposed skin, no noticeable change in skin in sun exposed sites when in temperate climates.

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**Table 2**

Age, Gender and adapted FST of the population

Variable	Mexican American (n=300)	Puerto Rican (n= 48)	Dominican (n =2)
Age in years mean (SD)	35 (10.5)	28 (8.2)	29
Gender- Female	207 (69%)	42 (89%)	2 (100%)
Adapted FST Spectrophotometric melanin index, mean ( $\pm$ SD)			
I 128 (25)	9 (3%)	0	0
II 320 (58)	127 (42.3%)	2 (4.2%)	0
III 354 (90)	132 (44.0%)	23 (47.9%)	0
IV 600 (38)	29 (9.7%)	21 (43.7%)	1
V 650 (40)	3 (1%)	2 (4.2%)	1
VI	0	0	0

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