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The expanding melanoma burden in California Hispanics: Importance of socioeconomic distribution, histologic subtype and anatomic location

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Abstract

Background—The incidence patterns and socioeconomic distribution of cutaneous melanoma among Hispanics are poorly understood.

Methods—We obtained population-based incidence data for all Hispanic and Non-Hispanic White (NHW) patients diagnosed with invasive cutaneous melanoma from 1988-2007 in the state of California. Using a neighborhood-level measure of socioeconomic status (SES), we investigated incidence, thickness at diagnosis, histologic subtype, and anatomic site and the relative risk (RR) for thicker (>2mm) versus thinner (≤2mm) tumors at diagnosis for groups categorized by SES.

Results—Age-adjusted melanoma incidence rates per million were higher in NHWs ($P < .0001$); tumor thickness at diagnosis was greater in Hispanics ($P < .0001$). Sixty-one percent of melanomas in NHWs occurred in the High SES group. Among Hispanics, only 35% occurred in the High SES group; 22% were of Low SES. Lower SES was associated with thicker tumors ($P < .0001$); this association was stronger in Hispanics. The relative risk (RR) for thicker versus thinner (≤2mm) tumors in Low-SES versus High-SES NHW men was 1.48 (95% CI, 1.37-1.61); it was 2.18 (95% CI, 1.73-2.74) in Hispanic men. Lower-SES patients had less superficial spreading melanoma subtype (especially among Hispanic men) and more nodular melanoma subtype. Leg/hip melanomas were associated with higher SES in NHW males but with lower SES in Hispanic males.

Conclusions—The socioeconomic distribution of melanoma incidence and tumor thickness differed substantially between Hispanic and NHW Californians, particularly among males.

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Melanoma prevention efforts targeted to lower-SES Hispanics and increased physician awareness of melanoma patterns among Hispanics are needed.

Keywords

Melanoma; social class; tumor thickness; Hispanic Americans; race; ethnicity

Melanoma incidence has increased substantially worldwide over the last few decades,¹⁻⁵ and melanoma has become a leading cause of cancer deaths in young adults.⁶⁻⁸ Most previous studies examining the expanding burden of melanoma in the United States (US) have focused on non-Hispanic White (NHW) populations in whom incidence is highest.⁹ However, little is known about the burden of melanoma among Hispanics, who comprise approximately 15% of the US population and represent its fastest-growing ethnic group. In California, more than 36% of the population is Hispanic.¹⁰ Melanoma incidence rates in the US are lower in Hispanics (4.5 per 100,000) than in NHWs (21.6 per 100,000),⁸ but melanomas in Hispanics are thicker and of later stage at diagnosis, are more likely to metastasize, and have worse overall outcomes than in NHWs.^{7, 11-17} Clinical characteristics including anatomic site of presentation and histologic subtype also differ between Hispanics and NHW, with more melanomas on the legs^{11, 14, 15, 18} and higher frequencies of acral lentiginous subtype (which occur on the palms, soles and subungual areas) in Hispanics.^{12, 14, 15} Among California Hispanics, increasing melanoma incidence from 1988-2001 was confined to thicker (> 1.5mm) tumors (associated with a worse prognosis),^{19, 20} a trend not observed in NHWs.²¹ A recent Florida study reported that the proportion of melanomas diagnosed at late stage in Hispanics improved little from 1990-2004 compared with the significant improvements observed in NHWs.¹⁷

The later stage at diagnosis and worse prognosis in Hispanics have been attributed to several factors, including lower access to health insurance,²² delayed seeking of treatment,^{15, 23} lower awareness of risks or symptoms,^{15, 24} a lack of linguistically or culturally-targeted screening efforts²⁵ and declines in sun-safe behaviors due to increasing acculturation.²⁶ Many of the above factors may be associated with lower socioeconomic status (SES). Prior studies have reported higher rates of melanoma in high-SES populations, but higher prevalence of late-stage melanoma and worse outcomes among low-SES, uninsured or poorly-insured populations.^{14, 16, 27-31} SES may therefore represent a critical component in understanding the melanoma burden among Hispanics, as Hispanics are more concentrated in lower-SES communities than are NHWs.

To further understand the burden of melanoma in Hispanics and especially how SES influences this burden, we focused on the large Hispanic population of California, and examined differences in melanoma characteristics between all Hispanics and NHW diagnosed with cutaneous malignant melanoma in California from 1988-2007. Our primary goal was to describe racial/ethnic differences in the socioeconomic distribution of overall melanoma incidence and the incidence of thicker (>2mm) tumors. We also examined differences in the socioeconomic distribution of melanoma histologic subtype and anatomic location.

METHODS

Source of cancer cases

Population-based melanoma incidence data were obtained from the California Cancer Registry (CCR), the statewide population-based cancer registry (www.ccrca.org) that contributes data to the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) program. Patients were residents of California diagnosed with invasive

cutaneous melanoma (International Classification of Diseases, 3rd edition (ICD-O-3) histology codes 8720-8790) between January 1, 1988 and December 31, 2007.

Patient demographic and tumor characteristics

Patient race/ethnicity was categorized as non-Hispanic white or Hispanic based on medical record report of race/ethnicity, supplemented by use of the National Hispanic Identification Algorithm (NHIA).¹¹ Patient SES was assigned on the basis of residence at diagnosis. We used an index SES measure incorporating US Census information on census block group-level education, median household income, proportion living 200% below poverty level, proportion of blue-collar workers, proportion greater than 16 years and unemployed, median rent and median house value, developed using principal components analysis as described by Yost et al., (2001)³² and used previously.^{5, 32, 33} Patients with unknown block group of residence (8.7%) were randomly assigned to a block group within their county. Standardized component scores for the index were categorized into quintiles (quintile 1 was lowest SES; quintile 5 was highest SES).

Given the limited number of Hispanics of higher SES, the two highest-SES quintiles were grouped into a High SES group; the third and fourth quintiles were grouped into a Middle SES group. These three SES groups (High, Middle, Low) were used in SES-specific analyses.

Melanoma tumor thickness (≤ 1.00 mm, 1.01-2.00mm, 2.01-4.00, and 4.01mm or more) was classified according to 2002 American Joint Committee on Cancer tumor categories.³⁴ Histologic subtype was classified by ICDO-3 code: superficial spreading melanoma (SMM): 8743; nodular melanoma (NM): 8721; acral lentiginous melanoma (ALM): 8744; lentigo maligna melanoma (LMM): 8742. Specified rare histologies (8722-8741, 8745-8790) were grouped with malignant melanomas of unspecified histology (MM, NOS): 8720; 99.97% of cases were confirmed microscopically. Anatomic site was categorized as head/neck (C44.0-C44.4), upper limb/shoulders (C44.6), trunk (C44.5), and lower limbs/hips (C44.7).

Statistical Analysis

SEER*Stat software was used to calculate case distributions and annual age-adjusted incidence rates (AAIRs) per 1,000,000 (standardized to the 2000 US standard) with 95% confidence intervals (CIs) for cutaneous melanoma from 1988-2007. Distributions were compared using chi-squared and Fisher exact tests; specific tests are noted in table footnotes. We estimated relative risks (RR) for case count data using the logit odds ratio. We calculated tests of linear trend using the Cochran-Armitage test for linearity. *P*-values less than .05 were considered statistically significant.

The SES distribution of the Hispanic and NHW populations varied by age, with a higher proportion of High-SES Hispanics in younger age groups. Our SES measure is at the census block-group level; population denominators at this level are available from the US Census only for decennial census years (1990 and 2000). Therefore, SES-specific AAIRs could only be calculated for the years 1988-2002 (where census-based denominators are likely to be stable), following our previous approach.⁵ We calculated AAIRs restricted to 1998-2002 in separate analyses (data not shown). We found no substantial differences between the results from those age-adjusted rate analyses and the results presented below.

RESULTS

Table 1 shows sociodemographic and clinical data for 83,859 NHW and 4,607 Hispanic Californians with incident melanomas reported between 1988-2007. Median age at diagnosis was significantly higher in NHWs (male: 61 years; females: 54 years) than in Hispanics (55

years and 47 years respectively; $P < .0001$). Hispanics had significantly lower neighborhood-level SES: greater than 40% of Hispanic melanoma patients were in quintile 1 (the lowest) or 2 of neighborhood SES versus 20% of NHWs, while only 16% of Hispanics were in quintile 5 (the highest) of neighborhood SES, compared to 33-35% of NHWs ($P < .0001$ for all).

Among males, average annual age-adjusted incidence rates were 286.1 per 1,000,000 for NHWs and 41.3 for Hispanics ($P < .001$). Among NHWs and Hispanic females, these rates were 183.7 and 41.8 ($P < .001$). Gender-specific rates varied by race/ethnicity: males accounted for 58% of melanomas in NHWs, but only 42% in Hispanics ($P < .0001$).

Clinical Melanoma Characteristics

Tumor thickness data was missing for 31% of NHW patients and 35% of Hispanic patients, consistent with other data from population-based cancer registries. There was a significant association between missing/unknown depth and SES in both Hispanics and NHWs ($p < .0001$; data not shown). However, this did not vary substantially by race/ethnicity: NHWs had 30% missing depth in quintile 1 (lowest SES quintile) and 19% in quintile 5 (highest SES quintile), while Hispanics had 33% and 21% missing in quintiles 1 and 5 respectively.

Missing tumor thickness was strongly associated with stage: for regional/distant (vs. localized) stage, NHW had a steadily increasing socioeconomic gradient of missing data (9% in quintile 5 increasing to 15% in quintile 1; data not shown). For Hispanics these rates of missing data similarly increased, from 12.5% in quintile 5 up to 25% in quintile 1.

Among those with known thickness, distributions differed significantly by race/ethnicity and gender. Mean age-adjusted tumor thickness was greater in Hispanic (1.80mm) versus NHW (1.22mm, $P < .0001$) males and Hispanic (1.47mm) versus NHW (1.07mm, $P < .0001$) females. In addition, a significantly higher percentage of Hispanic versus NHW males had tumors >2 mm thick at diagnosis (21% versus 14%, respectively, $P < .0001$). This difference was also observed for the thickest (>4 mm) tumors; approximately twice as many Hispanic males (10%) as NHW males (5%) had tumors >4 mm thick. An excess of thicker tumors was also observed among Hispanic females (15% had tumors >2 mm thick) compared to NHW females (10%).

ALM and NM subtypes comprised a higher percentage of melanomas in Hispanic males than in NHW males (Table 1: $P < .001$), while the SSM subtype comprised a smaller percentage ($P < .0001$). Aside from ALM, the distribution of histologic subtypes of melanoma was similar in Hispanic and NHW females. In both racial/ethnic groups, frequency of MM/NOS histology increased with decreasing SES: MM/NOS frequency increased from 46% in quintile 5 (highest SES quintile) to 51% in quintile 1 in NHWs, and from 46% in quintile 5 to 53% in quintile 1 in Hispanics (data not shown).

Hispanic males had significantly higher incidence of tumors on the lower limbs/hips than NHW males (25% versus 9%; $P < .001$) and lower incidence of tumors on the trunk (33% versus 41%; $P < .0001$).

Socioeconomic Status and Percentage of Thicker (>2 mm) Melanomas at Diagnosis

Lower-SES patients were more likely to have thicker tumors at diagnosis, irrespective of race/ethnicity or sex (P for trend $< .0001$ for all: Table 2). The association between lower SES and thicker tumors was considerably stronger among Hispanic than NHW men. When compared to High-SES NHW men, the relative risk (RR) for having tumors >2 mm among Middle-SES and Low-SES NHW men was 1.26 (95% CI: 1.20, 1.32) and 1.48 (95% CI:

1.37, 1.61), respectively. When compared to High-SES Hispanic men, the relative risk for thicker tumors was 1.77 (95% CI: 1.42, 2.20) for Middle-SES Hispanics men and 2.18 (95% CI: 1.73, 2.74) for Low-SES Hispanic men. These findings held among women as well: Low-SES NHW women had a RR of 1.63 (95% CI 1.46, 1.83) for thicker tumors compared to High-SES NHW women; the RR increased to 1.98 (95% CI: 1.55, 2.51) for Low-SES versus High-SES Hispanic women.

Over 60% of NHWs with melanoma were of High SES. Among Hispanics, however, High-SES individuals comprised only one-third of those with melanoma ($P < .0001$). Conversely, Low-SES NHWs made up only 6% of all NHW melanoma patients; but more than 20% of Hispanic patients ($P < .0001$)

This racial/ethnic difference in tumor burden by SES was stronger among thicker (>2mm) tumors: among NHWs, over 50% of these tumors occurred among High-SES individuals, while among Hispanic men and women only 19% and 24% of thicker tumors occurred in those of High SES ($P < .0001$ for both sexes). Conversely, only 8% of thicker tumors occurred in Low-SES NHWs, while 30% and 26% of thicker tumors occurred in Low-SES Hispanic men and women, respectively ($P < .0001$ for both sexes).

Socioeconomic Status and Melanoma Histologic Subtype

Among males, lower-SES patients had a lower percentage of SSM subtype (P for trend $< .0001$ within both race/ethnicities: Table 3). Again, this association was stronger in Hispanic than in NHW males. An association between lower SES and a higher percentage of patients with NM subtype was observed in all groups; there was little difference in the strength of this association by race/ethnicity or gender (Table 3). Among NHW and Hispanic males and females, P for trend was $< .0001$, $.0004$, $< .0001$, and $.039$ respectively.

Socioeconomic Status by Anatomic Site of Melanoma

High-SES NHW males had more lower limb/hip melanomas than low SES-NHW males (10% vs. 7%, $P < .0001$: Table 4). Conversely, High-SES Hispanic males had significantly lower proportions of these melanomas than Low-SES Hispanic males (19% vs. 27%, P for trend = $.0002$). While the percent of melanomas on the trunk was stable across SES categories for NHW males, it was significantly higher among High-SES versus Low-SES Hispanic males (34% versus 23%, P for trend = $.0003$). Head/neck and upper limb and shoulder melanoma rates did not vary by SES among either NHW or Hispanic males.

Associations between SES and anatomic location of melanomas did not vary as greatly by race/ethnicity among females. Among both NHW and Hispanic women, head/neck melanomas were significantly more common among lower-SES women. Unlike in men, lower limb and hip melanomas were only slightly more common among lower-SES versus High-SES Hispanic women.

DISCUSSION

In this study, the largest analysis of melanoma incidence in US Hispanics to date, we found that the distribution and overall burden of cutaneous melanoma, and the associations between SES and melanoma incidence and thickness in particular, were substantially different in Hispanic than in NHW Californians. Consistent with previous studies, our results showed that Hispanics had a lower incidence of melanoma than NHWs but were also more likely to have thicker tumors at diagnosis.^{7, 35-37} In addition, however, we found a much stronger burden of disease among lower-SES Hispanics than among NHWs, particularly among males. The association between low SES and higher risk of thicker tumors at diagnosis was also much stronger in Hispanic men. In secondary analyses, we

found that SES was strongly associated with anatomic site of melanoma in Hispanic men (unlike in NHW men), making clinicians' experience with melanoma in NHW potentially less applicable among Hispanics. Additionally, unlike in NHWs, melanoma histologic subtype differed strongly by SES among Hispanic men, with less SSM and more NM (the subtype accounting for most thicker melanomas)³⁸ in lower-SES Hispanic males.

As the first large, population-based study with adequate numbers of patients to examine socioeconomic differences between Hispanic and NHW melanoma patients, we found that roughly two-thirds of the melanoma burden in Hispanic males occurred among the Middle- and Low-SES groups. By comparison, over 60% of melanomas among NHWs occurred in those of High SES. These findings underscore the very different sociodemographic distribution of malignant melanoma in Hispanic versus NHWs Californians. Clearly, for California Hispanics, melanoma is not a "disease of the affluent" as it has been described among NHWs.³⁵

The association between lower SES and thicker melanoma was also stronger among Hispanics, to the extent that melanomas in Low-SES Hispanics were more than twice as likely to be >2mm thick than those in High-SES Hispanics. Our results suggest that lower-SES Hispanics may have poorer access to social, cultural, educational or job-related benefits which increases the physician delay in melanoma diagnosis compared with their lower-SES NHW counterparts. Differences between lower- and higher-SES Hispanics are likely to be complex and may involve language barriers, knowledge about and access to health institutions, and/or other difficult-to-measure components of social capital.^{39, 40} Sun-related behaviors and cultural norms may also differentially impact melanoma risk and detection among lower-SES Hispanics.^{26, 41}

We confirmed previously-reported higher frequencies of NM and lower frequencies of SSM subtype in Hispanics than in NHW.^{11, 15, 42} The socioeconomic gradients observed in the distribution of melanoma subtypes were stronger in Hispanics. The frequency of the SSM subtype in particular decreased sharply in lower-SES Hispanic males, while the frequency of NM was higher. The reasons for these findings are unclear, but may reflect racial/ethnic genetic susceptibilities for development of various melanoma subtypes, or environmental differences in the effect of chronic versus intermittent ultraviolet exposure on melanoma location and subtype. These novel findings require confirmation and further investigation.

We also confirmed previous reports that Hispanics have more leg/ hip melanomas and less truncal melanomas than NHWs.^{11, 15, 43} Leg/hip melanomas include those on the soles; therefore significantly higher rates of ALM among Hispanics help explain these findings.⁴² Racial/ethnic distribution differences were much stronger among males than females, however, which increased rates of ALM among Hispanics cannot explain. More detailed analyses will be required to elucidate associations between anatomic site and histopathology of melanoma by race/ethnicity.

Leg/hip melanomas were much more common among Hispanic males of Low versus High SES, whereas these melanomas were actually less common in Low- versus High-SES NHW males. Conversely, the frequency of melanomas on the trunk was lower in lower-SES Hispanic males; it did not vary appreciably by SES among NHWs. These SES associations suggest the causes of racial/ethnic differences in anatomic distribution of melanoma are not purely biological. While lower-SES Hispanics may be more likely to work in outdoor occupations in which their lower limbs receive greater sun exposure, previous studies have not found an association between continuous occupational sun exposure and increased melanoma incidence.⁴⁴ The role of UV exposure in melanoma incidence among Hispanics remains poorly defined, with conflicting findings in previous studies.^{45, 46} Regardless, our

data do suggest that dermatologists and primary care physicians should be aware of the importance of examining the skin on the hips and lower extremities of Hispanic male patients.

Limitations

This analysis utilized a large, reliable and up-to-date data source in the CCR, with access to all reported melanoma cases during the time period analyzed, in the US state with the largest population of Hispanics. In addition, our SES measure was created using a previously established measure that has been utilized in multiple published studies. However, our study also has several important limitations. First, our SES measure was an area-level and not an individual-level measure. Thus, observed SES differentials may relate to individual-level or a mixture of individual- and neighborhood-level influences. The mean individual-level SES of Hispanics and NHWs living in the same SES-categorized neighborhood may also be different. The CCR data are further limited in that they do not provide information on health insurance status or on certain melanoma anatomic sites such as plantar or subungual melanoma. Similarly, anatomic site-coding schemes in the CCR and other existing population-based registries do not differentiate melanomas on the legs from those on the hips (an area receiving less sun exposure).

Missing data rates were moderately high: 31% missing for tumor thickness in NHW and 35% in Hispanics, but were consistent with other population-based cancer registries. Missing thickness and histology were also inversely associated with SES, however, the associations were of similar magnitude in NHWs and Hispanics, so variations in missing data are unlikely to explain the differences between Hispanics and NHW that we observed. Histologic subtype was unspecified in approximately 50% of patients (although 99.97% of melanoma NOS cases were confirmed microscopically). Finally, it is important not to overgeneralize typical melanoma characteristics or presentation in a given population.

Altogether, our data suggest the need for different approaches to melanoma prevention and management in Hispanic populations than in NHW. Racial/ethnic differences in the socioeconomic distribution, socioeconomic gradient, thickness at diagnosis, and anatomic location of melanoma suggest that screening approaches used for NHWs may not effectively target Hispanics. Cockburn et al. (2006) showed that the incidence rate of thicker (>1.5mm) melanomas was increasing in California Hispanics and recommended primary and secondary prevention messages targeted to Hispanics. The lower SES of Hispanic melanoma patients and clear SES gradient in tumor thickness underline the need for these prevention messages to be accessible to those who 1) have a limited education; 2) have limited English language skills or speak only Spanish; 3) have recently immigrated to the US; or 4) have limited knowledge of and access to the American health care system. Such messages should include information regarding sun avoidance and protection as well as melanoma detection and skin self-examination techniques.

Clinicians should also take note of the marked racial/ethnic and socioeconomic differences in histologic subtype, anatomic location and tumor thickness observed here. In particular, health providers should be aware of the greater likelihood of thicker melanomas and more frequent tumors on the legs/hips in lower-SES Hispanic men.

Our observations of substantially greater proportions of thick melanomas among lower-SES Hispanic males in California serve as a public health warning regarding the need for effective management of melanoma in minority and poorer populations. While the absolute risk for melanoma is much lower in Hispanics, the large racial/ethnic disparities and socioeconomic gradients reported here show that melanoma prevention efforts in this population remain inadequate. Many fatal melanomas could be prevented every year by

concerted efforts to improve 1) prevention messages directed specifically at Hispanics and 2) awareness among health care practitioners of the risk for cutaneous melanoma among Hispanics in the US.

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Table 1

Melanoma Incidence in Hispanics and NHW in California by age, socioeconomic status and melanoma tumor characteristics; 1988-2007 (N=88,466)

	Males		Females	
	Non-Hispanic White	Hispanic	Non-Hispanic White	Hispanic
	N(%)	N(%)	N(%)	N(%)
Age				
0-49	13,386 (27.3%)	740 (38.4%)	14,302 (41.1%)	1,471 (54.6)
50-64	14,481 (29.5%)	516 (25.6%)	8,768 (25.2%)	590 (21.9%)
65+	21,152 (43.2%)	656 (36.0%) <i>P</i> <.0001 ^I	11,770 (33.7%)	634 (23.5%) <i>P</i> <.0001 ^I
Socioeconomic Status Quintile ²				
5 (Highest)	17,204 (35.1%)	306 (16.0%)	11,489 (33.0%)	445 (16.5%)
4	12,721 (26.0%)	322 (16.8%)	9,336 (26.8%)	543 (20.2%)
3	9,548 (19.5%)	385 (20.1%)	7,110 (20.4%)	585 (21.7%)
2	6,500 (13.3%)	432 (22.6%)	4,736 (13.6%)	571 (21.2%)
1 (Lowest)	3,046 (6.2%)	467 (24.4%) <i>P</i> <.0001	2,169 (6.2%)	551 (20.5%) <i>P</i> <.0001
Thickness (mm)				
<=1	25,454 (51.9%)	712 (37.2)	20,501 (58.8%)	1,360 (50.5%)
1.01-2	6,958 (14.2%)	278 (14.5%)	4,503 (12.9%)	374 (13.9%)
2.01-4	4,219 (8.6%)	223 (11.7%)	2,286 (6.6%)	236 (8.8%)
>=4.01	2,538 (5.2%)	186 (9.7%)	1,220 (3.5%)	163 (6.1%)
Unknown	9,850 (20.1%)	846 (26.8%) <i>P</i> <.0001	6,330 (18.2%)	562 (20.9%) <i>P</i> <.0001
Histology				
Superficial spreading melanoma	14,131 (28.8%)	417 (21.8%)	11,730 (33.7%)	839 (31.1%)
Nodular melanoma	4,126 (8.4%)	233 (12.2%)	2,393 (6.9%)	221 (8.2%)
Acral lentiginous melanoma	290 (0.6%)	113 (5.9%)	306 (0.9%)	109 (4.0%)
Lentigo maligna melanoma	2,935 (6.0%)	71 (3.7%)	1,471 (4.2%)	60 (2.2%)
Rare histologic subtypes	3,139 (6.4%)	115 (6.0%) <i>P</i> <.0001	1,747 (5.0%)	125 (4.6%) <i>P</i> <.0001
Unspecified	24,398 (49.8%)	963 (50.4%)	17,193 (49.5%)	1,341 (49.8%)
Anatomic site				
Head/neck	12,069 (26.2%)	419 (24.4%)	4,854 (14.5%)	399 (15.7%)
Trunk	18,947 (41.1%)	562 (32.7%)	8,388 (25.1%)	601 (23.7%)
Upper limbs/shoulders	10,873 (23.6%)	308 (17.9%)	9,497 (28.5%)	649 (25.6%)

	Males		Females	
	Non-Hispanic White	Hispanic	Non-Hispanic White	Hispanic
	N(%)	N(%)	N(%)	N(%)
Lower limbs/hip	4,234 (9.2%)	430 (25.0%) <i>P</i> <.0001	10,648 (31.9%)	891 (35.1%) <i>P</i> =.0003

¹*P*-values from chi-squared test comparing NHW and Hispanic across all non-missing categories.

²SES quintiles were calculated using a composite SES index incorporating US Census block group-level data on education, median household income, proportion living 200% below poverty level, proportion of blue-collar workers, proportion >16 years and unemployed, and median rent and house value.³²

Table 2

Melanoma Occurrence by Tumor Thickness at Diagnosis and Relative Risk (RR) of Thicker (>2mm) versus Thinner (≤2mm) Melanoma by Socioeconomic Status (SES), Stratified by Race/Ethnicity and Gender; California 1988-2007(N=88,466)

	High SES		Middle SES		Low SES		P for trend ²
	N (%)	RR ¹	N (%)	RR ¹ (95% CI)	N (%)	RR ¹ (95% CI)	
Males							
NH White							
≤2mm	20,775		9,946		1,691		
>2mm	3,832 (16%)	1.00	2,418 (20%)	1.26 (1.20, 1.32)	507 (23%)	1.48 (1.37, 1.61)	<.0001
Hispanic							
≤2mm	399		407		184		
>2mm	90 (18%)	1.00	196 (33%)	1.77 (1.42, 2.20)	123 (40%)	2.18 (1.73, 2.74)	<.0001
Females							
NH White							
≤2mm	15,515		8,144		1,345		
>2mm	1,882 (11%)	1.00	1,336 (14%)	1.30 (1.22, 1.39)	288 (18%)	1.63 (1.46, 1.83)	<.0001
Hispanic							
≤2mm	693		740		301		
>2mm	106 (13%)	1.00	186 (20%)	1.51 (1.22, 1.88)	107 (26%)	1.98 (1.55, 2.51)	<.0001

¹ Relative Risk (RR). Logit estimate of odds ratio (and 95% CI) comparing risk of having a thick (>2mm) versus thin (≤2mm) melanoma at diagnosis for people in each group vs. people in the High-SES group of the same gender and race/ethnicity group.

² Cochran-Armitage test for linearity; H₀: no linear trend in proportion of thick tumors across SES groups

Table 3

Melanoma Histologic Subtype by Socioeconomic Status (SES) group in Hispanic and Non-Hispanic White (NHW) males and females; California 1988-2007 (N=88,466)

Histologic Subtype of Melanoma	High SES			Middle SES			Low SES			P for trend ²
	Count	%	P ¹	Count	%	P ¹	Count	%	P ¹	
Males										
Non-Hispanic White										
SSM	9,046	30.2%		4,319	26.9%		766	25.2%		<.0001
NM	2,297	7.7%		1,490	9.3%		339	11.1%		<.0001
Other/unknown	18,582	62.1%		10,239	63.8%		1,941	63.7%		
Hispanic										
SSM	178	28.3%	.29	169	20.7%	<.0001	70	15.0%	<.0001	<.0001
NM	51	8.1%	.69	122	14.9%	<.0001	60	12.9%	.18	.0004
Other/unknown	399	63.5%	.43	526	64.4%	0.41	337	72.2%	.002	
Females										
Non-Hispanic White										
SSM	7,312	35.1%		3,787	32.0%		631	29.1%		<.0001
NM	1,224	5.9%		947	8.0%		222	10.2%		<.0001
Other/unknown	12,289	59.0%		7,112	60.0%		1,316	60.7%		
Hispanic										
SSM	342	34.6%	.59	343	29.7%	.083	154	28.0%	.7	<.0001
NM	67	6.8%	.27	97	8.4%	0.67	57	10.3%	.87	.039
Other/unknown	579	58.6%	.99	716	61.9%	0.16	340	61.7%	.80	

¹ Chi-squared P-value for difference between percentage of Hispanic and NHW patients with a specific melanoma subtype within a specific SES group by gender.

² Cochran-Armitage P-value for statistical significance of a linear trend in the frequency of a specific melanoma subtype by SES within a racial/ethnic and gender subgroup.

Table 4

Melanoma Anatomic Site by Socioeconomic Status (SES) group in Hispanic and Non-Hispanic White (NHW) males and females; California 1988-2007 (N=88,466)

Anatomic Site of Melanoma	High SES		Middle SES		Low SES		<i>P</i> ² for trend
	Count	%	Count	%	Count	%	
Males							
Non-Hispanic White							
Upper limb and shoulder	6,735	22.5%	3,473	21.6%	665	21.8%	.48
Head/neck	7,181	24.0%	4,119	25.7%	769	25.3%	<.0001
Trunk	11,601	38.8%	6,216	38.7%	1,130	37.1%	.55
Lower limb and hip	2,842	9.5%	1,181	7.4%	211	6.9%	<.0001
Overlap/NOS	1,566	5.2%	1,059	6.6%	271	8.9%	
Hispanic							
Upper limb and shoulder	105	16.7%	133	16.3%	70	15.0%	.74
Head/neck	134	21.3%	187	22.9%	98	21.0%	.64
Trunk	216	34.4%	239	29.3%	107	22.9%	<.0001
Lower limb and hip	120	19.1%	183	22.4%	127	27.2%	<.0001
Overlap/NOS	53	8.4%	75	9.2%	65	13.9%	.0002
Females							
Non-Hispanic White							
Upper limb and shoulder	5,601	26.9%	3,279	27.7%	617	28.5%	.005
Head/neck	2,684	12.9%	1,801	15.2%	369	17.0%	<.0001
Trunk	5,085	24.4%	2,845	24.0%	458	21.1%	.036
Lower limb and hip	6,702	32.2%	3,332	28.1%	614	28.3%	.001
Overlap/NOS	753	3.6%	589	5.0%	111	5.1%	
Hispanic							
Upper limb and shoulder	263	26.6%	261	22.6%	125	22.7%	.034
Head/neck	125	12.7%	165	14.3%	109	19.8%	<.0001

Anatomic Site of Melanoma	High SES		Middle SES		Low SES		P^2 for trend
	Count	%	Count	%	Count	%	
Trunk	228	23.1%	276	23.9%	97	17.6%	.027
Lower limb and hip	307	31.1%	398	34.4%	186	33.8%	.23
Overlap/NOS	65	6.6%	56	4.8%	34	6.2%	

¹ Chi-squared P -value for difference between percentage of Hispanic and NHW patients with a specific anatomic location of melanoma within a specific SES group by gender.

² Cochran-Armitage P -value for statistical significance of linear trend in the frequency of a specific anatomic location of melanoma by SES, within racial/ethnic and gender subgroups.