California Medicaid Enrollment and Melanoma Stage at Diagnosis

A Population-Based Study

Ricardo A. Pollitt, PhD, Christina A. Clarke, PhD, MPH, Sarah J. Shema, MS, Susan M. Swetter, MD

Background: Insurance status and SES are associated with the stage of melanoma at diagnosis. However, the influence of Medicaid enrollment on melanoma stage has not been studied in detail. This study examined the effect of Medicaid enrollment status and duration on melanoma stage at diagnosis in a large, multi-ethnic California population.

Methods: California Cancer Registry records were linked with statewide Medicaid enrollment files to identify 4558 men and women diagnosed with invasive cutaneous and metastatic melanoma during 1998–1999. Multivariate logistic regression was used to evaluate the association between prediagnosis Medicaid enrollment status and late-stage diagnosis and tumor depth at diagnosis.

Results: Late-stage disease was diagnosed in 27% of Medicaid and 9% of non-Medicaid melanoma patients. Those enrolled in Medicaid at diagnosis and those enrolled intermittently during the year prior to diagnosis had significantly greater covariate-adjusted odds of late-stage cancer than those not enrolled in Medicaid (OR 13.64, 95% CI=4.43, 41.98, and OR 2.77, 95% CI=1.28, 5.99, respectively). Participants continuously enrolled during the previous year were not at increased odds for late-stage disease. An increased likelihood of late-stage melanoma was also associated with low SES ($p<0.05$) and non-Hispanic black race/ethnicity ($p<0.10$) after covariate adjustment.

Conclusions: Men and women intermittently enrolled in Medicaid or not enrolled until the month of diagnosis had a significantly increased likelihood of late-stage melanoma. Greater education and outreach, particularly in low-SES areas, are needed to improve melanoma awareness and access to screening.

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Introduction

Melanoma outcomes differ strongly by tumor thickness at diagnosis[1]; thus, understanding the disparities of SES and race/ethnicity that affect the stage at diagnosis is of considerable clinical and public health importance. While an increased incidence of melanoma is associated with markers of higher SES, a more-advanced stage at diagnosis is associated with lower SES.[2] The risk of late-stage melanoma also varies by race/ethnicity, with African Americans, Asians, and Hispanics at higher risk than non-Hispanic whites,[3–5] although melanoma is much less likely to occur in these groups. However, race/ethnicity does not appear to entirely mitigate socioeconomic disparities in late-stage melanoma.[2,6–8]

A major determinant of melanoma stage at diagnosis in the U.S. is health insurance. A 1994 study of Florida melanoma patients found a four-fold higher risk of late stage at diagnosis for those covered by Medicaid compared to those with commercial indemnity insurance.[7] More-recent studies have reported associations between the status and duration of Medicaid enrollment and the late-stage diagnosis of breast, colorectal, pancreatic, and cervical cancers,[9–12] implying that people not enrolled in Medicaid or those enrolled for shorter periods prior to cancer diagnosis are at greatest risk for more-advanced cancer. These associations have not yet been examined for melanoma.

To better understand disparities in late-stage melanoma, this study jointly examined the effects of SES, race/ethnicity, and the timing of Medicaid enrollment on two measures of melanoma progression (stage of

From the Department of Dermatology, Pigmented Lesion and Melanoma Program, Stanford University School of Medicine (Pollitt) and Stanford Comprehensive Cancer Center (Swetter), and the Department of Health Research and Policy (Clarke), Stanford; the Northern California Cancer Center (Clarke, Shema), Fremont; and the Dermatology Service, Veterans Affairs Palo Alto Health Care System (Swetter), Palo Alto, California

Address correspondence and reprint requests to: Susan M. Swetter, MD, Dept. of Dermatology, Pigmented Lesion and Melanoma Program, Stanford University Medical Center, 900 Blake Wilbur Drive, W0069, Stanford CA 94305. Email: sswetter@stanford.edu.

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disease and tumor depth), taking advantage of a linked cancer registry–Medicaid resource available for the large, multi-ethnic population of California.

Methods

Melanoma Case Ascertainment

Population-based melanoma case information was obtained from the California Cancer Registry (CCR), which has conducted statewide cancer surveillance since 1988.[13] All cases of incident invasive cutaneous and metastatic melanoma diagnosed between January 1, 1998, and December 31, 1999, among California residents aged <65 were considered.

Data included patient demographic characteristics, tumor characteristics, and treatment for 4 months following diagnosis. Demographic measures were categorized according to (1) race/ethnicity—non-Hispanic white (white); non-Hispanic black (black); Hispanic; and non-Hispanic Asian (Asian); (2) age at diagnosis (15–29, 30–39, 40–49, 50–59, and 60–64)[11]; (3) marital status (married or not married); and (4) date of diagnosis (typically from the date of first positive microscopic confirmation).

The CCR does not routinely collect patient education or income information, but prior studies have derived a composite index of neighborhood-level SES from census data geocoded to patient address at diagnosis. Census block group-level information on income, poverty, education, home value, and blue-collar status were used to compute a composite neighborhood-level SES score. This score is divided into quintiles (Quintile 1=residence in lowest-SES census block group; Quintile 5=residence in highest-SES block group). Neighborhood-level SES has been associated previously with cancer, cardiovascular disease, and other health outcomes, although it may represent somewhat different constructs than individual-level SES.[11,14–16]

Stage at diagnosis was defined according to Surveillance, Epidemiology, and End Results (SEER) summary stage 1977 guidelines as localized (skin only); regional (lymph node involvement); or distant (distant sites or nodes involved). Stage was grouped into two categories: early (localized cutaneous disease) and late (regional and visceral metastasis). One hundred sixty patients with unknown stage—eight of whom were enrolled in Medicaid—were excluded from this analysis. Tumor histologic subtypes were classified according to the ICD, Oncology (2nd ed.): nodular melanoma (NM, morphology code 8721); lentigo maligna melanoma (LMM, 8742); superficial spreading melanoma (SSM, 8743); acral lentiginous melanoma (ALM, 8744); spindle cell melanoma (8772); and melanoma not otherwise specified (NOS, 8720).[17] Desmoplastic melanomas were excluded due to insufficient numbers.

Tumor thickness was categorized as thin (≤2 mm) or thick (>2 mm) because survival differences among cutaneous melanoma stages (as determined by the American Joint Committee on Cancer) are most apparent at this tumor cut-off point.[18] Data on tumor thickness were available for 4153 (91%) participants; analyses on tumor thickness were limited to this subset. Patients missing stage or tumor-depth data did not differ significantly from those with known outcomes with respect to study variables (data not shown).

Linkage with Medicaid Enrollment Files

All protocols were approved by the State of California IRB. Medicaid enrollment status was determined from linkage with monthly Medicaid (termed Medi-Cal in California) enrollment files provided by the Medical Care Statistics Section of the California Department of Health Services Methods for 1995–1999.[11,12] Standard probabilistic linkage software (Integrity) was used to match Medicaid enrollment files to CCR patient files according to Social Security number; first, middle, last, and alias names; birth day, month, and year; and ZIP code of residence. Manual review was performed to confirm all possible matches.

Two measures were used to characterize Medicaid enrollment: (1) a yes/no measure of enrollment status at time of diagnosis, and (2) a categorical variable with four levels. Those levels were (1) first enrolled in Medicaid at the month of diagnosis, (2) enrolled during the month of diagnosis and 1–11 months prior to diagnosis, (3) enrolled during the month of diagnosis and for at least 12 months prior to diagnosis, and (4) not enrolled in Medicaid at diagnosis. These categories of Medicaid enrollment permitted assessment of the potential influence on outcome of being screened through Medicaid or other health insurance services during the year prior to melanoma diagnosis. Sensitivity analyses were performed to take into account the potential effects of misclassifying patients who may have retroactively enrolled in Medicaid after their diagnosis. Patients enrolled in Medicaid within 3 months before diagnosis were alternately categorized into Levels 1 and 2 of the 4-level Medicaid enrollment variable. Model results were not significantly different using these two categorizations, so these patients remained in their original category.

Month of melanoma diagnosis was known for 5781 matched melanoma patients aged 15–64. Of these, 1223 were excluded either because data were missing for one or more of the measures of melanoma stage (n=160); race/ethnicity (n=525); gender (n=10); or SES (n=573), or because of unusual/infrequent histologic subtype (n=165), for a sample size of 4558.

Statistical Analyses

Demographic and melanoma characteristics of the study participants were evaluated and compared using T-tests and chi-squared statistics. Multivariate logistic regression was utilized to examine the associations between Medicaid status and melanoma stage. Two sets of models were run, examining the impact of the dichotomous Medicaid variable and the effect of the 4-level Medicaid variable. Models were adjusted for neighborhood SES, race/ethnicity, age, gender, histology, year at diagnosis, and marital status. Effect modification was evaluated by assessing the significance of interaction terms between Medicaid variables and covariates, using a cut-off of p=0.2 for stratification. In the subset of 4153 participants with tumor-depth data, logistic regression was used to examine the effect of the dichotomous Medicaid variable on melanoma depth at diagnosis. The reference group in all models was patients not enrolled in Medicaid. Analyses were conducted in 2007, using SAS 9.1. All tests of significance were two-sided; significance was defined as p<0.05.

Table 1. Characteristics of 4558 California melanoma patients by Medicaid enrollment status

	Not enrolled in Medicaid (n=4441) n (%)	Enrolled in Medicaid (n=117) n (%)	Total (N=4558) n (%)
SEER summary stage*			
Localized	4020 (90.5)	85 (72.7)	4105 (90.1)
Regional/distant	421 (9.5)	32 (27.4)	453 (9.9)
Tumor depth (mm), mean ± SD*	1.12 ± 1.33	1.98 ± 2.22	1.14 ± 1.37
Tumor depth[a],*			
≤2 mm depth	3545 (87.3)	65 (67.7)	3610 (86.8)
>2 mm depth	512 (12.7)	31 (32.3)	543 (13.2)
Gender*			
Male	2397 (54.0)	41 (35.0)	2438 (53.5)
Female	2044 (46.0)	76 (65.0)	2120 (46.5)
Age at diagnosis, mean ± SD**	46.2 ± 11.0	43.2 ± 11.7	46.1 ± 11.0
Age at diagnosis (years)			
15–34	714 (16.1)	28 (23.9)	742 (16.3)
35–44	1139 (25.6)	30 (25.6)	1169 (25.6)
45–54	1433 (32.3)	37 (31.6)	1470 (32.3)
55–64	1155 (26.0)	22 (18.8)	1177 (25.8)
Neighborhood SES quintile*			
1	215 (4.8)	38 (32.5)	253 (5.6)
2	503 (11.3)	28 (23.9)	531 (11.7)
3	897 (20.2)	27 (23.1)	924 (20.3)
4	1235 (27.8)	14 (12.0)	1249 (27.4)
5 (highest)	1591 (35.8)	10 (8.6)	1601 (35.1)
Race/ethnicity*			
Non-Hispanic black	21 (0.5)	3 (2.6)	24 (0.5)
Non-Hispanic white	4137 (93.2)	89 (76.1)	4226 (92.7)
Non-Hispanic Asian	33 (0.7)	1 (0.9)	34 (0.8)
Hispanic	250 (5.6)	24 (20.5)	274 (6.0)
Marital status*			
Married	2633 (59.3)	45 (38.5)	2678 (58.8)
Not married	1808 (40.7)	72 (61.5)	1880 (41.2)
Histologic subytpe (%)			
Superficial spreading melanoma	1735 (39.1)	30 (25.6)	1765 (38.7)
Nodular melanoma	342 (7.7)	15 (12.8)	357 (7.8)
Lentigo maligna melanoma	96 (2.2)	3 (2.6)	99 (2.2)
Acral lentiginous melanoma	38 (0.9)	3 (2.6)	41 (0.9)
Spindle cell melanoma	43 (1.0)	2 (1.7)	45 (1.0)
Melanoma, NOS	2187 (49.3)	64 (54.7)	2251 (49.4)

[a]Tumor-depth data were available on a subset of 4153 patients.
*p<0.001; **p<0.01
mm, millimeter; NOS, not otherwise specified; SEER, Surveillance, Epidemiology, and End Results

Results

Of the 4558 California residents with melanoma, 117 (2.6%) were enrolled in Medicaid during the month of melanoma diagnosis (Table 1). Women and unmarried individuals were significantly more likely to be covered by Medicaid at melanoma diagnosis than were men and married participants. Age and Medicaid enrollment status were not strongly associated, but decreasing neighborhood SES was associated with a graded, significant increase in Medicaid enrollment. Black and Hispanic melanoma patients were significantly more likely to be enrolled in Medicaid than whites and Asians.

Among the 117 men and women enrolled in Medicaid at the time of their melanoma diagnosis, 16 (14%) were enrolled for the first time during the month of their diagnosis; 37 (32%) had been enrolled for a period of from 1 to 11 months (continuously or non-continuously) during the year prior to diagnosis; and 64 (55%) had been enrolled for the entire past year (Table 2). Individuals living in higher-SES neighborhoods were equally likely to have been enrolled in Medicaid for a longer period of time compared with those in lower-SES neighborhoods. However, white race/ethnicity was associated with a longer period of Medicaid enrollment during the 1-year period prior to diagnosis when compared to Hispanic race/ethnicity; sufficient data were available to compare only these two groups.

Patients with late-stage melanoma were significantly more likely to be enrolled in Medicaid at the time of diagnosis than those with localized disease (p<0.0001). There was a significant association between less time enrolled in Medicaid during the year prior to diagnosis and later stage; 17% of individuals enrolled during the

Table 2. Characteristics by enrollment history of 117 melanoma patients enrolled in Medicaid at diagnosis

	Enrolled at month of diagnosis (n=16) n (%)	Enrolled 1–11 months prior to diagnosis (n=37) n (%)	Enrolled for all 12 months prior to diagnosis (n=64) n (%)
SEER summary stage*			
Localized	5 (31.3)	27 (73.0)	53 (82.8)
Regional/distant	11 (68.7)	10 (27.0)	11 (17.2)
Tumor depth (mm), mean ± SD*	3.4 ± 3.2	1.7 ± 1.9	2.0 ± 2.2
Tumor depth*			
≤2 mm depth	3 (42.9)	24 (70.6)	38 (69.1)
>2 mm depth	4 (57.1)	10 (29.4)	17 (30.9)
Gender*			
Male	8 (50.0)	13 (35.1)	20 (31.3)
Female	8 (50.0)	24 (64.9)	44 (68.7)
Age at diagnosis, mean ± SD**	46.7 ± 11.2	41.4 ± 11.5	43.3 ± 11.8
Age at diagnosis (years)			
15–34	3 (18.8)	11 (29.3)	14 (21.9)
35–44	4 (25.0)	10 (27.0)	16 (25.0)
45–54	5 (31.3)	10 (27.0)	22 (34.4)
55–64	4 (25.0)	6 (16.2)	12 (18.7)
Neighborhood SES quintile*			
1	4 (25.0)	12 (32.3)	22 (34.4)
2	4 (25.0)	9 (24.3)	15 (23.4)
3	5 (31.3)	6 (16.2)	16 (25.0)
4	2 (12.5)	6 (16.2)	6 (9.4)
5 (highest)	1 (6.3)	4 (10.8)	5 (7.8)
Race/ethnicity*			
Non-Hispanic black	1 (6.3)	0 (0)	2 (3.1)
Non-Hispanic white	10 (62.5)	28 (75.7)	51 (79.7)
Non-Hispanic Asian	0 (0)	0 (0)	1 (1.6)
Hispanic	5 (31.3)	9 (24.3)	10 (15.6)
Marital status*			
Married	8 (50.0)	16 (43.2)	21 (32.8)
Not married	8 (50.0)	21 (56.8)	43 (67.2)
Histologic subtype			
Superficial spreading melanoma	1 (6.3)	12 (32.4)	17 (26.6)
Nodular melanoma	1 (6.3)	5 (13.5)	9 (14.1)
Lentigo maligna melanoma	0 (0)	0 (0)	3 (4.7)
Acral lentiginous melanoma	1 (6.3)	0 (0)	2 (3.1)
Spindle cell melanoma	0 (0)	1 (2.7)	1 (1.6)
Melanoma, NOS	13 (81.3)	19 (51.4)	32 (50.0)

*p<0.001; **p<0.01
mm, millimeter; NOS, not otherwise specified; SEER, Surveillance, Epidemiology, and End Results

entire year had late-stage disease versus 69% of those enrolled during their month of diagnosis (p<0.001). Tumor depth was also strongly associated with a history of Medicaid enrollment; those enrolled in Medicaid at diagnosis were significantly more likely to be diagnosed with melanoma greater than 2 mm (p<0.001). The mean tumor depth was 3.4 mm among those newly enrolled in Medicaid, compared to 1.7 mm and 2.0 mm among those enrolled for 1–11 months and 12+ months, respectively.

Individuals enrolled in Medicaid in the month of their melanoma diagnosis were 21 times as likely to have late-stage disease compared to those not covered by Medicaid at all (OR 21.00, 95% CI=7.26, 60.73; Table 3). Those enrolled in Medicaid for 1–11 months and 12+ months before diagnosis had ORs for late-stage diagnosis of 3.54 (95% CI=1.70, 7.36) and 1.98 (95% CI=1.03, 3.82), respectively, when compared to those not covered by Medicaid. Associations were attenuated by multivariate adjustment, but remained significant for individuals enrolled in Medicaid only at diagnosis (OR 13.64, 95% CI=4.43, 41.98) and for 1–11 months before diagnosis (OR 2.77, 95% CI=1.28, 5.99).

Neighborhood SES quintile was strongly associated with odds of late-stage melanoma. Even after risk-factor adjustment, individuals in the lowest three SES quintiles had ORs for late-stage diagnosis of 2.40 (95% CI=1.61, 3.58); 1.69 (95% CI=1.23, 2.34); and 1.49 (95% CI=1.12, 1.98), versus those in the highest SES quintile, respectively. In additional logistic models that included all covariates except for the SES measures, the adjusted ORs for the Medicaid variables increased by 20% to 35%, although little change was observed in the CIs. A further set of models included all covariates but excluded the Medicaid measures; in these models, the

Table 3. ORs for late-stage melanoma diagnoses among 4558 men and women in California, 1998–1999

	Crude OR (95% CI)	Adjusted[a] OR (95% CI)
Medicaid enrollment and coverage		
Enrolled at diagnosis, not before	21.00 (7.26, 60.73)	13.64 (4.43, 41.98)
Enrolled for 1–11 mo. before	3.54 (1.70, 7.36)	2.77 (1.28, 5.99)
Enrolled for 12 or more mo. before	1.98 (1.03, 3.82)	1.30 (0.64, 2.64)
Not covered by Medicaid	1.0	1.0
Race/ethnicity		
Asian/Pacific Islander	1.64 (0.63, 4.26)	1.60 (0.59, 4.31)
Hispanic	1.58 (1.11, 2.25)	1.11 (0.74, 1.65)
Non-Hispanic black	3.92 (1.62, 9.51)	2.45 (0.92, 6.55)
Non-Hispanic white	1.0	1.0
SES quintile		
1	3.04 (2.12, 4.36)	2.40 (1.61, 3.58)
2	2.06 (1.52, 2.80)	1.69 (1.23, 2.34)
3	1.58 (1.20, 2.08)	1.49 (1.12, 1.98)
4	1.10 (0.83, 1.45)	1.10 (0.83, 1.46)
5 (highest)	1.0	1.0
Age at diagnosis (years)		
15–34	1.18 (0.86, 1.61)	1.24 (0.89, 1.72)
35–44	1.0	1.0
45–54	1.23 (0.95, 1.60)	1.23 (0.94, 1.61)
55–64	1.20 (0.91, 1.58)	1.15 (0.86, 1.53)
Marital status		
Unmarried	1.10 (0.90, 1.33)	1.07 (0.86, 1.31)
Married	1.0	1.0
Gender		
Male	1.62 (1.33, 1.98)	1.66 (1.34, 2.05)
Female	1.0	1.0
Histologic subtype		
Superficial spreading melanoma	0.39 (0.30, 0.50)	0.40 (0.31, 0.52)
Nodular melanoma	2.59 (1.98, 3.40)	2.39 (1.81, 3.16)
Lentigo maligna melanoma[b]	—	—
Acral lentiginous melanoma	2.82 (1.40, 5.70)	2.34 (1.10, 4.99)
Spindle cell melanoma	1.66 (0.77, 3.61)	1.53 (0.70, 3.38)
Melanoma, NOS	1.0	1.0

[a]Adjusted for neighborhood SES, race/ethnicity, age, gender, histologic subtype, and marital status
[b]Small cell sizes prevented the calculation of odds for this category.
mo., month; NOS, not otherwise specified

OR for the SES measures increased by 0% to 9%, while the ORs for Hispanic and black race/ethnicity increased by 6.6% and 8.2%, respectively.

Race/ethnicity was strongly associated with late-stage diagnosis. Hispanics and blacks had significantly higher unadjusted odds of having late-stage disease at diagnosis than whites. Risk-factor adjustment attenuated the OR to nonsignificance for Hispanics (OR 1.11, 95% CI=0.74, 1.65) and blacks (OR 2.45, 95% CI=0.92, 6.55).

Age and marital status were not associated with late-stage diagnosis, but men had significantly higher odds of having metastatic disease than women (adjusted OR 1.66, 95% CI=1.34, 2.05). Nodular melanomas were significantly more likely to be late-stage at diagnosis than malignant melanoma NOS, while SSM and LMM had lower odds of late-stage diagnosis.

The impact of Medicaid enrollment (ever, never) on stage at diagnosis was also examined. Individuals on Medicaid at diagnosis were >3 times more likely to have late-stage melanoma at diagnosis than those not on Medicaid (OR 3.60, 95% CI=2.37, 5.47). Multivariate adjustment attenuated the OR to 2.55 (95% CI=1.61, 4.04). The ORs for the other covariates differed only slightly from those presented in Table 3 (data not shown).

Among the subset of 4153 participants with tumor-depth data, similar analyses were carried out, using the dichotomous Medicaid variable and the thick (>2 mm) versus thin (≤2 mm) tumor-depth outcome variable. Results were comparable to those for tumor stage at diagnosis. Individuals with Medicaid coverage were significantly more likely to have thick tumors at diagnosis than those not on Medicaid coverage (OR 3.31, 95% CI=2.14, 5.13); this association remained (OR 2.37, 95% CI=1.42, 3.97) after multivariate adjustment.

Discussion

In a population-based series of 4558 melanoma patients, those enrolled in Medicaid were more likely to have advanced disease (measured both by stage of

disease and tumor depth) than those with no evidence of Medicaid enrollment. The duration of Medicaid enrollment, however, strongly influenced this association. People newly enrolled in Medicaid were 13 times more likely to have later-stage disease, people intermittently enrolled in Medicaid were more than twice as likely to have later-stage disease, and people continuously enrolled in Medicaid were just as likely to have advanced disease than those not on Medicaid. These associations remained after adjustment for SES, race/ethnicity, age, marital status, and histologic subtype. Low neighborhood SES and male gender were also independent risk factors for later stage at melanoma diagnosis.

The finding that men and women continuously enrolled in Medicaid during the year prior to diagnosis did not have greater odds for late-stage disease suggests that the screening services provided through Medicaid were adequate. Those who were not continuously enrolled, however, were at increased risk of later-stage disease, and the increasing OR gradient observed by decreasing the length of time enrolled indicates that continuous access to screening is essential for decreasing the likelihood of advanced stage at diagnosis.

The only prior study examining the impact of Medicaid enrollment on melanoma stage at diagnosis found an adjusted OR of late-stage diagnosis for Medicaid enrollees of 4.69 (95% CI=1.90, 11.56) compared to individuals with commercial indemnity insurance.[7] In the present analysis, those enrolled in Medicaid (yes/no enrollment variable) also had significantly greater odds of late-stage disease, as well as greater odds of having a tumor depth >2 mm. The current study's results vis-à-vis duration of Medicaid enrollment underscore the importance of including prior enrollment history in studies utilizing Medicaid data. Studies analyzing other types of cancer have also reported the existence of an inverse gradient between the length of previous Medicaid enrollment and the likelihood of advanced-stage disease.[9–12]

Several studies have described associations between low SES and an increased likelihood of late-stage melanoma at diagnosis, and report that the effect of SES on late diagnosis operates independently of race/ethnicity.[2,6,8,19–22] The results of the current study also showed a clear inverse gradient by neighborhood SES, with individuals living in lower-SES neighborhoods being significantly more likely to have late-stage melanoma at diagnosis than those in high-SES neighborhoods, even after covariate adjustment. The finding that these neighborhood SES–late stage disease associations remained significant after adjustment for Medicaid enrollment further supports the notion that cancer screening in low-SES neighborhoods in California is inadequate, similar to prior analyses.[11]

Previous studies have reported that Hispanics, Asians, and blacks have higher rates of late-stage melanoma at diagnosis than whites.[3,5,23] In this contemporary Californian population, Hispanics and blacks had significantly higher unadjusted odds of late-stage melanoma at diagnosis than whites. After covariate adjustment, the likelihood for late-stage disease among blacks remained marginally significant, while the likelihood among Hispanics was substantially attenuated. These results suggest that much of the difference in melanoma outcome between Hispanics and whites in California is due to the effect of SES and insurance coverage. These data are of interest, given a 2006 study reporting that recent increases in melanoma incidence in the Californian Hispanic population have been primarily in thicker (>1.5 mm) tumors.[4] Together, these results indicate that increased education on sun avoidance and skin self-examination may be of particular importance in this population.

Older age was not associated with more late-stage melanoma in this analysis. As in previous studies, males were more likely to have late-stage disease.[24] Similar to prior analyses, nodular melanomas were more likely to be later-stage than melanoma of unclassified histology,[25] while superficial spreading and lentigo maligna melanomas were less likely to be late-stage. However, nearly 50% of melanoma subtypes were not specified, which limits the interpretation of this finding.

To the authors' knowledge, this study represents the largest published person-year assessment of insurance status and melanoma outcome. Advantages include the use of a large linked resource from the multi-ethnic population of California and a previously validated measure of SES. Unlike prior studies, this analysis adjusted for the potential biological importance of histologic subtype and used two different outcome measures of melanoma progression. Study limitations include limited statistical power due to the small number (n=117) of melanoma patients enrolled in Medicaid at melanoma diagnosis, which discouraged race/ethnicity-specific Medicaid analyses among non-Hispanic Asians and blacks. Furthermore, individuals who were truly uninsured could not be distinguished from insured individuals who did not link with the Medicaid files, which may have attenuated the ORs for late-stage disease among those enrolled in Medicaid. It has been shown previously that cancer registry data regarding Medicaid status have only modest agreement with linkage,[26] so cancer registry data sources regarding patient insurance status were not utilized to further explore this issue.

Additionally, Medicaid allows individuals to apply retrospectively for benefits up to 3 months prior to enrollment, and it was not possible to determine whether the 30 individuals enrolled in Medicaid from 1 to 3 months before diagnosis were retrospectively enrolled (and therefore misclassified). However, analyses of this group indicated that their odds of late-stage disease were lower than that of individuals enrolled at diagnosis, but higher than that of individuals enrolled

4–11 months prior to diagnosis. These findings suggest that the overall gradient of risk observed in this study is accurate.

In summary, late-stage melanoma was present in 9% of all newly diagnosed California melanoma patients but in 27% of those enrolled in Medicaid. Length of enrollment in Medicaid was a key variable. Individuals enrolled continuously in Medicaid for more than 1 year did not have a greater likelihood of late-stage disease than those not on Medicaid, whereas individuals enrolled intermittently had significantly higher odds of late-stage disease, and those enrolled at diagnosis had the greatest odds of late-stage disease. Access to skin screening for melanoma through Medicaid is thus apparently successful if individuals are continuously enrolled in the year prior to diagnosis. Hispanic individuals did not have significantly higher odds of having late-stage melanoma at diagnosis, a finding contrary to recent studies that requires confirmation. Finally, lower neighborhood SES was also a significant independent predictor of late-stage disease, emphasizing the need for improved education and screening in low-SES communities to promote the early detection of melanoma.

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