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Socioeconomic status and chemotherapy use for melanoma in older people

Carlos A. Reyes-Ortiz[1], **James S. Goodwin**[2], **Dong D. Zhang**[2], and **Jean L. Freeman**[2]

[1] Department of Social & Behavioral Sciences, School of Public Health, University of North Texas Health Science Center, Fort Worth, TX 76107-2699

[2] Sealy Center on Aging, Department of Internal Medicine-Geriatrics, University of Texas Medical Branch, 301 University Blvd., Galveston, TX 77555-0460

Abstract

The objective of this study was to examine the association between areal socioeconomic status (SES) and receiving chemotherapy among older persons with cutaneous melanoma. A retrospective cohort study, SEER-Medicare linked database, 1,239 white men and women aged ≥ 66 years, with invasive melanoma (regional and distant stages; 1991–1999). Receiving chemotherapy was defined as at least one claim within 6 months after diagnosis of melanoma. SES was measured by census tract poverty level (average of 1990 and 2000 Census data). Covariates were sociodemographics, tumor characteristics and comorbidity index. Residing in poorer SES areas was associated with a lower likelihood for receiving chemotherapy among patients in the overall sample (adjusted odds ratios= OR 0.97, 95% confidence interval= CI 0.95–0.99), and those with regional stage at diagnosis (OR 0.97, 95% CI 0.94–0.98). These findings reflect socioeconomic disparities in chemotherapy use for melanoma among older white patients in the United States.

Keywords

socioeconomic status; chemotherapy; older people; melanoma

Malignant melanoma is associated with an excellent long-term prognosis when detected and treated at an early stage. Surgery alone is sufficient for patients with thin melanomas. Patients with thicker tumors or with ulcerated lesions, who are at higher risk for metastasis, may benefit from additional therapy beyond surgical removal of the tumor. Adjuvant and neo-adjuvant chemotherapies are designed to reduce the risk of melanoma recurrence. Adjuvant chemotherapy is used after surgical excision for the primary lesion with nodal biopsies, and neo-adjuvant chemotherapy is used before surgery for the primary lesion (1–6).

Demographic and tumor characteristics, quality of life variables, patient's preference and attitudes, and physician's patient's preference and attitudes are considered potential explanatory variables for chemotherapy use in melanoma (7–10). It is generally assumed that patients form preferences and make decisions after they have been informed by their physician. Preferences for treatment are thus usually assessed after patients have received information concerning their treatment options. However, patients also have information

Address correspondence to Carlos A. Reyes-Ortiz, MD, PhD; Department of Social & Behavioral Sciences, School of Public Health, University of North Texas Health Science Center; 3500 Camp Bowie Boulevard (EAD-711B); Fort Worth, Texas, 76107-2699; Phone: 1-817-735-5136; Fax: 1-817-735-0255; carlos.reyesortiz@unthsc.edu.

from family, friends, media or the Internet. Based on these sources of information, most patients may already have an idea about chemotherapy and whether they want it for themselves or not (9,10). To what extent these preferences translate into treatment decision, and particularly for melanoma, are unknown.

Socioeconomic status (SES), as measured by individual-level or area-level income, education or occupation, along with patient's preferences or physician's behaviors may affect access for cancer treatment (11,12). Studies have shown a relationship between SES and chemotherapy use and other treatment choices for breast, lung and colon cancer (13–15). Chemotherapy use is highly correlated to high aggregate/areal SES measures and high SES is correlated to other markers for access to cancer treatment such as access to a medical oncologist (16). Indeed, most chemotherapies are administered at a community or outpatient setting (≥70%), thus areal SES also captures chemotherapy availability (16). Then, SES may determine access to chemotherapy in patients with various types of cancer (13–15). However, there is limited information on the association between SES and chemotherapy use for melanoma (6). On the other hand, some studies have shown that among persons aged 65 and older covered by Medicare in the United States, those with higher socioeconomic status or those who purchase supplemental health insurance are more likely to undergo cancer screening than those with low socioeconomic status or those without supplemental insurance (17–19). Thus, we expect variations on chemotherapy use associated with socioeconomic status even if older patients are covered by Medicare. The objective of this study is to explore the association between SES and chemotherapy use to treat invasive melanoma. The hypothesis is that residing in high SES areas is associated with a greater likelihood of chemotherapy use in older patients with invasive melanoma and covered by Medicare.

Materials and Methods

Data sources

The cohort of this analysis was derived from the linked (Surveillance Epidemiology and End Results) SEER-Medicare database. The SEER-Medicare database was created in 1992 through collaboration of the National Cancer Institute (NCI), the SEER registries and the Center for Medicare and Medicaid Services (CMS) to cancer costs, services, variation, and outcomes (20–24). This database provides accurate and precise tumor staging, tumor characteristics (i.e., thickness, ulceration, nodes, site, histology), and date of diagnosis information from SEER and long-term diagnostic, procedure, cost, utilization, and comorbidity information from Medicare (20–22).

Cases reported by the SEER registries from 1973 to 1993 have been matched against Medicare's master enrollment file. Of person's ≥ 65 years of age appearing in the SEER records, Medicare eligibility could be identified for 94% of cases (25). While SEER maintains a standard case ascertainment of 98% (20,23), the SEER-Medicare link captures 88% of melanoma cases (26). The Medicare claims data used in the study included the following: 1- Medicare Provider Analysis and Review file, which contains inpatient hospital claims, available from 1988; 2-the Hospital Outpatient Standard Analytic File, which contains claims for outpatient facility services; and 3- the 100% Physician/Supplier file, which contains claims for physicians and other professional services (27). These last two data were available for all beneficiaries from 1991, and Medicare claims were available through midyear 2000. To identify complete claims for chemotherapy after diagnosis, we choose cases diagnosed from1991 to 1999.

Study population

The initial study population consisted of all male and female patients who were diagnosed with melanoma from 1991 to 1999 (n=31,244), in the SEER-Medicare database (Table 1). Patients were restricted to those 66 and over allowed identification of comorbid conditions one year prior to diagnosis, since most patients are eligible for Medicare coverage at age 65. Patients for whom melanoma was not the first diagnosis of cancer were also excluded, since they may receive chemotherapy for other cancers. Patients who did not have full coverage of both Medicare Part A and Part B or who were members of Health Maintenance Organizations (HMO) because claims from these patients may not be complete were also excluded. Patients with *in situ* and localized stage at diagnosis since they are not likely to receive chemotherapy, or those with unknown historic stage at diagnosis, which may lead to uncertainty or may include *in situ* cases, were excluded. Patients with unknown census tract poverty level (the primary variable of interest) were excluded. Finally, non-white patients (Hispanics=41; blacks=14; other=25) were excluded because it is not clear that melanoma is the same disease in people with different degree of baseline pigmentation. Thus 1,239 patients with invasive melanoma (regional and distant stages) were available for these analyses. We focused the primary analyses and discussion on patients with regional stage at diagnosis since the standard of care is mostly related to this group, and because patients with distant stage at diagnosis of melanoma may receive systemic treatment for palliative purposes and these patients may have transitioned through earlier stages of disease but are not identifiable from the SEER database which only records stage at diagnosis (1–6).

Outcome

Chemotherapy use was defined as at least one claim for chemotherapy (any systemic anti-cancer therapy) within specified time periods after diagnosis of melanoma (6 months) (7,8), and dichotomized into yes and no. The procedures and revenue center codes for chemotherapy administration made within 24 months of diagnosis of melanoma were assessed. These codes included the following International Classification for Diseases (9th revision, clinical modification [ICD-9-CM]) procedure or revenue codes: 9925 for a hospital inpatient or outpatient facility claim of chemotherapy (injection or infusion of cancer chemotherapeutic substance) (28); 96400to 96549, J9000 to J9999, and Q0083 to Q0085 for a physician or outpatient claim of chemotherapy administration (29,30); and 0331 (chemotherapy injected), 0332(chemotherapy oral), and 0335 (chemotherapy intravenous) for an outpatient claim of chemotherapy (16,31). The ICD-9-CM V codes (21) of V58.1, V66.2, or V67.2 for follow-up examination or care after chemotherapy were also used. Because SEER reported only the month and year of diagnosis of melanoma, we arbitrarily defined the day of diagnosis in SEER as the 15th of the month. For inpatient claims for chemotherapy, diagnosis was defined as date of admission. For outpatient and physician claims, diagnosis was defined as the earliest date of service.

Socioeconomic status

Investigators have pointed out the need of both individual and aggregate socioeconomic measures to establish the influence of socioeconomic factors in health (32). There is an important literature on how neighborhoods' socioeconomic status affects health outcomes particularly in the United Sates (32,33). Other investigators have reported that aggregate census data may be considered a close proxy of both individual-level and areal-level socioeconomic data (33–35). Thus, in our study, we used aggregate SES for two reasons: first, to overcome the absence of individual SES information in SEER health records, and second, to include a marker of both individual and areal SES. Since patient-level economic data are not collected by the SEER cancer registries, the SEER-Medicare data contains socioeconomic status of the patient's Census tract residency area at the time of diagnosis

and is measured in terms of the percentage of residents living at or below the poverty level (36). Because the time period was from 1991 through 1999, these Census poverty estimates were calculated as average values for the 1990 and 2000 Census years. Poverty levels were used both as quartiles (Tables 2 & 3) and as a continuous variable (Table 4).

Other measures

Age was divided into two categories 66–74 and 75 and over. Other variables were gender (male, female), and marital status (married and unmarried/unknown).

Historic stage at diagnosis was categorized as *in situ*, localized, regional, distant and unknown. After exclusion of *in situ*, localized and unknown the remained sample included regional and distant stages (see above and Table 1). Tumor thickness (Breslow depth in mm) was categorized as ≤ 2.00, >2.00 & unknown. Ulceration was categorized as present and absent/not specified. Number of positive nodes was categorized as one or more (≥ 1) and none (=0) or not reported. Histology was categorized into nodular, lentigo maligna, superficial spreading, and other (including acral lentiginous). Site of the tumor was categorized into trunk, face, upper limb, lower limb, and not specified.

Comorbidity was ascertained from Medicare claims data through diagnoses or procedures made one year before the diagnosis of melanoma. We used the comorbidity index created by Charlson et al. (37) and later validated by Romano et al. (38) using ICD-9-CM diagnosis and procedure codes. Medicare inpatient and outpatient claims were searched for comorbid conditions. Comorbidity was categorized into 0–1 and ≥2.

Statistical Analyses

Pearson's chi-square test was used to evaluate, first, the relationship between chemotherapy use and patient characteristics with stages at diagnosis (regional vs. distant, Table 2), and, second, to test difference in rates (%) for receiving chemotherapy across SES (poverty quartiles), patient and tumor characteristics in those patients with regional stage disease (Table 3). Logistic regression analyses were used to examine the relationship between SES (poverty as continuous variable) and chemotherapy use, while controlling for other variables, considered likely to affect the use of chemotherapy in subjects with melanoma (Table 4) (1–6). The Breslow-Day test for homogeneity of odds ratios showed no significant difference related to chemotherapy use between the regional and distant stages at diagnosis. For all analyses, a significance level of $p<0.05$ was used, two-tailed. All computer programming and analyses were completed using Version 9.1 of the SAS system for Windows (SAS Institute, Cary, NC).

Results

Table 2 presents key characteristics of older patients with invasive cutaneous melanoma in the total population and across stage at diagnosis categories (regional and distant), between the years 1991 and 1999. In the total population, 22% of patients received chemotherapy. Patients with distant stage at diagnosis had higher percentages for receiving chemotherapy compared to those with regional stage at diagnosis. Most of cases with distant stage do not have thickness reported (71.5%); this affects the distribution of the percentages of distant stage by thickness categories in the table. Indeed, distant stage melanoma has spread beyond the original area of skin and nearby lymph nodes to other organs such as the lung, brain or liver, or to distant areas of the skin and lymph nodes (5,6). Neither the lymph node status nor thickness is considered in this stage, but typically is thick and has also spread to lymph nodes.

Table 3 presents the characteristics of older patients with regional stage at diagnosis of cutaneous melanoma and percentages receiving chemotherapy. Patients who reside in wealthy areas, who were younger (66–74 years), and who reported being married as well as those with thicker lesions or with one or more positive nodes were more likely to receive chemotherapy.

Table 4 presents the multivariate logistic regression analyses for receiving chemotherapy as a function of SES after a diagnosis of cutaneous melanoma, in the total population and by each category of stage at diagnosis. Patients residing in poorer SES areas were less likely to receive chemotherapy than those residing in wealthier SES areas. This was true for patients in the overall sample and those with regional stage at diagnosis, but not those with distant stage at diagnosis. Other factors associated with having chemotherapy were younger age compared with older age and being married compared to unmarried. In additional multivariate analyses, with no exclusion of patients with HMO, we obtained similar results for poverty predicting chemotherapy, where patients residing in poorer areas have lower odds for receiving chemotherapy among those of the total sample (OR=0.97, 95% CI 0.95–0.99) or those classified as having regional stage at diagnosis (OR=0.97, 95% CI 0.94–0.98).

Discussion

In this study, chemotherapy use for invasive melanoma was associated with SES, and this association remained after adjusting for relevant factors. Overall, the prevalence of chemotherapy use for treatment of melanoma was lower in patients living in poorer SES areas compared with patients living in wealthier SES areas. In multivariate analyses, SES was an independent predictor of chemotherapy use.

The decreased chemotherapy use among non-Hispanic whites' patients residing in poorer areas is probably related to worse access to health care. There is one report in the literature on melanoma research to compare with our results. When analyzing factors associated with survival among patients with invasive cutaneous melanoma in California, Zell et al. (6) found a significant association between high SES and treatment with chemotherapy and immunotherapy. Other studies have also shown that socioeconomic conditions may mediate cancer care in the United States (13–15).

On the other hand, other studies agree that socioeconomic status affects the enrollment of subjects in cancer clinical trials. In one study using data from the US National Cancer Institute-sponsored cancer treatment clinical trials, including colorectal, lung, lymphoma and leukemia, Sateren et al. (11) reported that geographic areas with higher socioeconomic levels (measured at a county level: mean income, mean poverty, and mean education) had significantly higher levels of clinical trials accrual. In a case-control study, using the National Cancer Institute cooperative group breast cancer trials and the linked SEER-Medicare databases, Gross et al. (12) reported that low SES (measured by % below poverty level within the zip code area, and Medicaid coverage) was associated inversely with trial enrollment for older women with breast cancer. By contrast, in a population-based study, Polednak (39) reported that poverty rate of area of residence in Connecticut was not associated with chemotherapy use in non-elderly breast cancer patients.

Older age was associated with low chemotherapy use in this study. There are no population studies related to age and chemotherapy use for melanoma in the literature, but this study may reflect in part what happened in the recruitment of melanoma patients for treatment in general patient care or clinical trials. Melanoma clinical trials usually do not have age as an exclusion criterion (40–43); however, some have age limit (e.g., <75 yr) (44,45), and others

consider “significant illnesses” as an exclusion criterion (46,47). Thus many older patients may not qualify for inclusion.

Among tumor characteristics, thickness and number of positive nodes were independent predictors of chemotherapy use for treatment of melanoma. This finding agrees with some previous studies (40,41,44–47). Histology and site, with the exception of unknown site or location in lower limb, were not associated with chemotherapy use.

This study has some limitations. Subjects enrolled in an HMO were excluded because claims were not generated or were incomplete for chemotherapy use. Historically, HMOs have not been required by CMS to submit claims or other services information received by their Medicare enrollees (23); therefore, the lack of claims data for HMO enrollees is a significant limitation of the SEER-Medicare database. This could introduce a bias in our selected population. However, we did not find differences across poverty levels comparing HMO enrollees to no-enrollees, and we showed that when including HMO in our statistical model, we got similar results for poverty levels predicting chemotherapy use for melanoma. Measuring SES by the Census’ area poverty levels was a limitation in this study as there is no method available to measure individual poverty, as we mentioned in methods; however, areal-level SES is an indicator of both individual and areal SES. Due to inherent selection biases for treatment and diagnosis, retrospective data from SEER must be evaluated with caution. For example, surgery, especially in earlier stages at diagnosis, is the best treatment and most frequently used choice to treat patients with melanoma, while chemotherapy is used in very selective cases with invasive melanoma (6). The data did not allow the authors to distinguish between therapy with interferon, interleukin, other biological, dacarbazine and other cytotoxics. We could not control for clinical trials enrollment criteria and physician bias that may affect the decision on systemic therapy for melanoma patients.

This study has also strengths. It was derived from the linked SEER-Medicare data, a population-based tumor registry. Chemotherapy use comparisons for other cancers have been used based on this database (7,8,16), and Administrative Medicare claims data appear to be a valid source of information for chemotherapy administered to older Medicare beneficiaries with cancer (48). This study estimates disparities related to SES after adjusting for relevant demographic factors and tumor characteristics. To authors’ knowledge, this is the first report in the literature on melanoma focused on this association between chemotherapy use and SES. Other studies reported disparities in survival from melanoma related to SES among older persons (49).

The results of this study may have applications in public health. First, although all patients in this study are covered by Medicare, those residing in low SES areas are less likely to get chemotherapy. This suggests that beyond Medicare insurance coverage, that is considered part of the affordability dimension of health care access (50) and coordinated care-payment, residing in low SES areas may influence other dimensions for access to chemotherapy and other chemo-related health care among older patients with melanoma. These include availability (e.g., oncologist supply), accessibility (e.g., transportation, distance to clinic), accommodation (e.g., appointment systems) and acceptability (e.g., attitudes between providers and patients) for chemotherapy procedures that should be explored in further studies. For example, since more than 70% of chemotherapies are administered at the community setting (outpatient), for a community, low SES area is likely placing that community in a market place where few chemo-providers can serve. Second, health providers may target appropriate information on options for chemotherapy treatment among patients and their families residing in low SES areas.

In conclusion, SES was associated with chemotherapy use in older white patients with melanoma. Indeed, subjects residing in poorer SES areas had lower odds of receiving chemotherapy than subjects residing in wealthier SES areas. This reflects a disparity across SES groups among older white patients in the United States.

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Table 1

Selection of patients with diagnosis of cutaneous melanoma, years 1991–1999 (N= 31,244)

Removed	Remained	Patients removed (compared to those who remained) were more likely to have these characteristics
Patients age <66 at diagnosis (8,630)	N= 22,614	Married, non-white, less poor, invasive stage
Patients for whom melanoma was not the first diagnosis of cancer (4,230)	N= 18,384	Older (75+), male, married, less poor, white, in situ stage
Patients without full coverage of Medicare Part A & Part B, during 12 months before diagnosis and 6 months after diagnosis (1,478)	N= 16,906	Younger (66–74), male, poor, non-white
Patients at HMO, during 12 months before diagnosis and 6 months after diagnosis (4,095)	N= 12,811	Male, married, non-white
Patients with in situ (4,652) or localized (4,765) or unknown (702) historic stage at diagnosis	N= 1,346	Younger (66–74), unmarried, less poor
Patients with unknown census tract poverty level (27)	N= 1,319	Non-white
Non-white patients (80)	N= 1,239	Poor
	regional (1,032), & distant (207)	

HMO= health management organization

Table 2

Characteristics of older white men and women with invasive cutaneous melanoma in the total population and across stage at diagnosis categories (regional and distant), 1991–1999

		Stage at diagnosis		
Characteristic	**Total (n=1,239)**	**Regional (n=1,032)**	**Distant (n=207)**	**p-value[b]**
	%	%	%	
Chemotherapy				0.0004
Yes	22.1	20.3	31.4	
No	77.9	79.7	68.6	
Census tract poverty level % [a]				0.54
<3.87% (wealthier)	25.0	25.5	22.7	
3.87% to 6.65%	25.0	25.4	23.2	
6.66% to 11.00%	24.9	24.8	25.6	
>11.00% (poorer)	25.1	24.3	28.5	
Age				0.69
66–74 yr	36.5	36.2	37.7	
≥ 75 yr	63.5	63.8	62.3	
Gender				0.90
Male	56.9	57.0	56.5	
Female	43.1	43.0	43.5	
Marital status				0.19
Married	53.0	52.8	54.1	
Unmarried/Unknown	47.0	47.2	45.9	
Comorbidity				0.55
0–1	91.0	89.9	92.3	
≥ 2	9.0	10.1	7.7	
Histology				<.0001
Superficial spreading	15.1	17.3	3.9	
Nodular	25.1	28.9	6.3	
Lentigo maligna	3.2	3.6	1.4	
Other	56.6 [c]	50.2 [d]	88.4 [e]	
Body site				<.0001
Trunk	16.8	18.3	9.2	
Face	26.8	29.5	13.5	
Upper limb	21.2	23.3	10.6	
Lower limb	20.3	23.2	6.3	
Not specified	14.9	5.7	60.4	
Thickness of tumor (mm)				<.0001
≤ 2	30.5	33.0	17.9	

		Stage at diagnosis		
Characteristic	**Total (n=1,239)**	**Regional (n=1,032)**	**Distant (n=207)**	**p-value[b]**
> 2	45.8	52.9	10.6	
Unknown/not specified	23.7	14.1	71.5	
Ulceration				<.0001
Present	41.1	49.2	0.5	
Absent/not specified	58.9	50.8	99.5	
Positive nodes				0.07
≥ 1	15.2	16.0	11.1	
0 or not reported	84.8	84.0	88.9	

[a] Quartiles for average percentage from 1990 & 2000 US Census data

[b] Differences for each characteristic across the two categories of stage at diagnosis (regional and distant) were tested and calculated using the Pearson's Chi-square test.

Other histology category included acral lentiginous

[c] 2.6%

[d] 3.0%

[e] 0.5%

Table 3

Characteristics of older white men and women with regional stage at diagnosis of cutaneous melanoma and percentages receiving chemotherapy, 1991–1999

Variables	Number (%)	% Receiving chemotherapy	P value[b]
Overall	1032 (100)	20.3	
Census tract poverty level % [a]			0.0119
<3.87% (wealthier)	263 (25.5)	24.3	
3.87% to 6.65%	262 (25.4)	21.8	
6.66% to 11.00%	256 (24.8)	18.7	
>11.00% (poorer)	251 (24.3)	15.9	
Age			<.0001
66–74 yr	374 (36.2)	28.9	
≥ 75 yr	658 (63.8)	15.3	
Gender			0.08
Male	588 (57.0)	22.1	
Female	444 (43.0)	17.8	
Marital status			0.0004
Married	545 (52.8)	24.4	
Unmarried/Unknown	487 (47.2)	15.6	
Comorbidity			0.19
0–1	928 (89.9)	20.8	
≥ 2	104 (10.1)	15.4	
Histology			0.72
Superficial spreading	179 (17.3)	19.6	
Nodular	298 (28.9)	20.1	
Lentigo maligna	37 (3.6)	13.5	
Other	518 (50.2) [c]	21.0 [d]	
Body site			0.05
Trunk	189 (18.3)	18.5	
Face	304 (29.5)	17.8	
Upper limb	241 (23.3)	19.1	
Lower limb	239 (23.2)	22.6	
Not specified	59 (5.7)	33.9	
Thickness of tumor (mm)			0.0026
≤ 2	341 (33.0)	14.7	
> 2	546 (52.9)	22.5	
Unknown/not specified	145 (14.1)	24.8	
Ulceration			0.09
Present	508 (49.2)	44.0	

Variables	Number (%)	% Receiving chemotherapy	P value[b]
Absent/not specified	524 (50.8)	56.0	
Positive nodes			<.0001
≥ 1	165 (16.0)	33.3	
0 or not reported	867 (84.0)	17.8	

[a] Quartiles for average percentage from 1990 & 2000 US Census data

[b] To test differences for receiving chemotherapy across categories or variables, P values were calculated using the Pearson's Chi-square test. Including acral lentiginous

[c] n=31 (3.0%); receiving chemotherapy

[d] 16.1%

Table 4

Multivariate logistic regression analyses for receiving chemotherapy as a function of SES after diagnosis of cutaneous melanoma in older white men and women, 1991–1999

	All patients (n=1,239)	Patients with regional stage (n=1,032)	Patients with distant stage (n=207)
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
Census tract poverty level % (continuous)	**0.97 (0.95–0.99)**	**0.97 (0.94–0.98)**	0.98 (0.95–1.03)
Age ≥ 75 yr (vs. 66–74)	**0.46 (0.35–0.62)**	**0.50 (0.36–0.69)**	**0.34 (0.17–0.65)**
Female gender (vs. male)	0.83 (0.61–1.14)	0.79 (0.55–1.13)	0.99 (0.50–2.03)
Married (vs. unmarried)	**1.51 (1.12–2.04)**	**1.46 (1.04–2.05)**	1.75 (0.88–3.49)
Comorbidities ≥2 (vs. 0–1)	0.63 (0.37–1.09)	0.74 (0.41–1.32)	0.30 (0.06–1.47)
Distant stage (vs. regional)	**1.64 (1.04–2.58)**	N/A	N/A
Histology			
Nodular	1.00	1.00	1.00
Lentigo maligna	1.11 (0.42–2.94)	1.05 (0.37–2.99)	1.76 (0.09–33.8)
Superficial spreading	1.17 (0.72–1.88)	1.15 (0.71–1.89)	0.82 (0.07–9.09)
Other	1.10 (0.75–1.61)	1.05 (0.71–1.56)	0.83 (0.14–4.89)
Body site			
Trunk	0.63 (0.38–1.03)	**0.57 (0.33–0.96)**	1.13 (0.22–5.76)
Face	0.67 (0.42–1.06))	0.70 (0.43–1.13)	0.29 (0.04–2.03)
Upper limb	0.86 (0.55–1.34)	0.75 (0.47–1.20)	1.82 (0.38–8.75)
Lower limb	1.00	1.00	1.00
Not specified	0.98 (0.54–1.75)	1.31 (0.62–2.76)	0.84 (0.21–3.37)
Tumor thickness (mm)			
≤ 2	1.00	1.00	1.00
> 2	**1.82 (1.27–2.62)**	**1.92 (1.31–2.82)**	1.37 (0.31–6.10)
Unknown/not specified	**1.64 (1.02–2.64)**	1.74 (0.99–3.06)	1.26 (0.51–3.15)
Ulceration			
Present	0.95 (0.67–1.33)	1.02 (0.72–1.45)	---
Absent/not specified	1.00	1.00	
Positive nodes			
≥ 1	**1.89 (1.31–2.73)**	**1.97 (1.32–2.94)**	1.57 (0.54–4.58)
0 or not reported	1.00	1.00	1.00

[a] Average percentage from 1990 & 2000 US Census data

OR= odds ratios, CI= confidence intervals. In bold are significant ($p<0.05$) odds ratios.

N/A= does not apply; --- = no data