## Sociodemographic disparities in survival of cutaneous angiosarcoma

*To the Editor:* Cutaneous angiosarcoma is a relatively rare mesenchymal malignancy with variable presentations that can lead to delays in diagnosis.[1] An epidemiologic study conducted by Conic et al[2] examined the Surveillance, Epidemiology, and End Results program and found age and extent of disease as factors affecting survival in cutaneous angiosarcoma. We would like to note the significant effect of county income level and urbanization on survival in patients with cutaneous angiosarcoma, 2 factors not examined in the previously mentioned study. Though similar associations have been noted in patients with melanoma, it is not well recognized in patients with cutaneous angiosarcoma.[3,4]

Patients from the 18-server Surveillance, Epidemiology, and End Results program were surveyed between 2000 and 2017 for a diagnosis of angiosarcoma (*International Classification of Diseases, 10th revision* code 9120) with a primary cutaneous site (44.0-44.9), resulting in a cohort of 782 patients.[5] Descriptive statistics for patient factors were conducted with the Fisher exact test (n = 782). Multivariate analyses for disease-specific survival were conducted with the Kaplan–Meier method with log-rank statistic and Cox regression hazards analysis. For multivariate analysis, disease-specific death was compared with patients who were alive or died of other causes. Patients with missing income level, residence, and cause of death information were excluded (n = 777). Interaction was also analyzed by Cox regression analysis to compare survival in patients with both factors of interest to the independent survival rates. All statistical analyses were conducted with SPSS software (v 27; IBM Corp, Chicago, IL).

Descriptive statistics findings are summarized in Table I. There were significant associations between low median household income level (MHIL) and black race, as well as between low MHIL and geographic residence. Using the Kaplan–Meier method, lower MHIL ($P = .007$) and residence in a nonmetropolitan area ($P = .046$) were both significantly associated with lower survival in patients with cutaneous angiosarcoma. This significance persisted in Cox regression analysis for both low MHIL (hazard ratio [HR] 1.45; $P < .05$) and nonmetropolitan residence (HR 1.46; $P < .05$) and is modeled in Fig 1. Interaction analysis between low MHIL and nonmetropolitan residence demonstrated lower survival in the interaction variable group, with a HR of 1.50 ($P < .05$). Consistent with the original study by Conic et al,[2] survival in black patients was not significantly different when compared with survival in white patients (HR 0.726; $P = .324$). Interaction analysis between black race and low MHIL was nonsignificant ($P = .23$).

**Table I.** Patient factors stratified by median household income level

| | <$65,000 | ≥$65,000 | *P* value* |
|---|---|---|---|
| Mean age, y (n = 782) | 73.5 | 73.4 | .72 |
| Gender (n = 782) | | | .57 |
| Male | 169 (46.2) | 197 (53.8) | |
| Female | 201 (48.3) | 215 (51.7) | |
| Race (n = 766) | | | |
| White | 319 (46.8) | 363 (53.2) | |
| Black | 27 (73.0) | 10 (27.0) | <.05 (vs white)† |
| Other | 16 (31.1) | 31 (68.9) | |
| Ethnicity (n = 782) | | | .45 |
| Hispanic/Latino | 25 (53.2) | 22 (46.8) | |
| Non-Hispanic/Latino | 345 (46.9) | 390 (53.1) | |
| Site (n = 661) | | | .24 |
| Face | 85 (50.3) | 84 (49.7) | |
| Scalp/neck | 133 (48.7) | 140 (51.3) | |
| Trunk | 93 (42.5) | 126 (57.5) | |
| Geographic location (n = 782) | | | |
| Metropolitan | 296 (42.5) | 401 (57.5) | |
| Nonmetropolitan | 74 (87.1) | 11 (14.9) | <.05† |
| Pathologic grade (n = 362) | | | .83 |
| Well differentiated | 23 (48.9) | 24 (51.1) | |
| Moderately differentiated | 38 (52.1) | 35 (47.9) | |
| Poorly differentiated | 68 (56.2) | 53 (43.8) | |
| Undifferentiated | 63 (52.1) | 58 (47.9) | |
| Extent of disease (n = 782) | | | .75 |
| Localized | 171 (47.8) | 187 (52.2) | |
| Regional | 85 (45.2) | 103 (54.8) | |
| Distant | 20 (42.6) | 27 (57.4) | |
| Unstaged | 94 (49.7) | 95 (50.3) | |
| Surgical therapy (n = 780) | | | .56 |
| Surgery performed | 263 (45.8) | 311 (54.2) | |
| Surgery not recommended | 89 (51.1) | 85 (48.9) | |
| Surgery recommended but not performed | 17 (53.1) | 15 (46.9) | |

Values in parentheses are percentages as compared across median household income level. Patients who did not receive surgery may have received alternate therapy, but that was not reported.

*Calculated with the Fisher exact test.

†Statistically significant ($P < .05$).

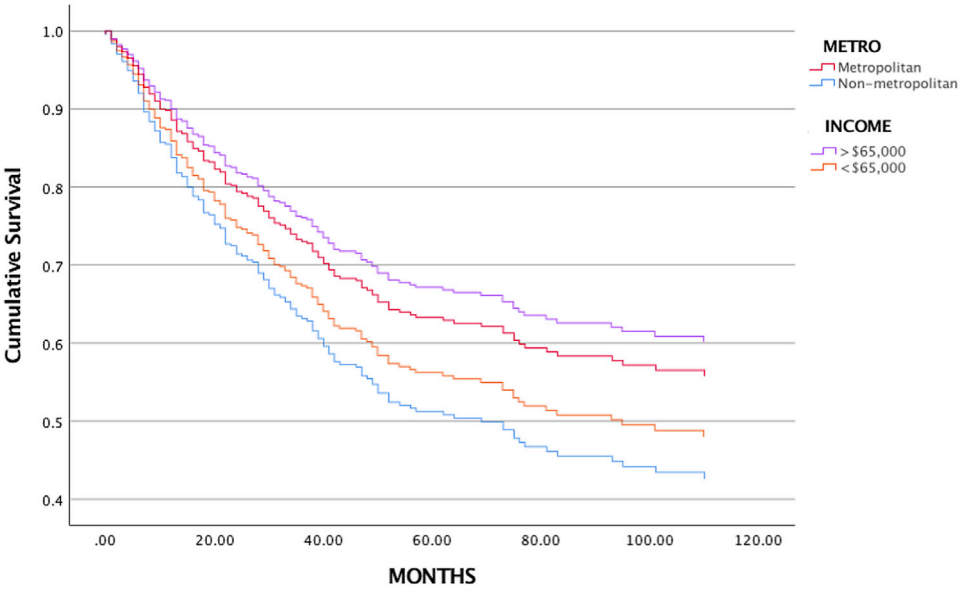


**Fig 1.** Disease-specific survival stratified by median household income level (MHIL) and urbanization. Cox regression analysis yielded a hazard ratio (HR) of 1.46 for nonmetropolitan residence compared with metropolitan residence (95% confidence interval 1.003-2.128; $P < .05$) and a HR of 1.45 for lower MHIL when compared with higher MHIL (95% confidence interval 1.102-1.896; $P < .05$).

This demonstrates 3 main findings. First, cutaneous angiosarcoma patients of lower income counties and patients of nonmetropolitan areas of residence were independently found to have lower survival. Second, patients who lived in lower income counties that were also nonmetropolitan were found to have disproportionately lower survival. Finally, though black patients more often resided in lower income counties, within the same county income level, race did not affect survival.

One theory to explain these disparities is that residence in lower income or nonmetropolitan counties may mean greater difficulty in traveling to metropolitan hospital systems that presumably have more expertise in these skin conditions.[4] In addition to possible inaccuracies, weaknesses of this public dataset include lack of information on distance to the closest hospital and the location of each patient's treatment, which may affect survival.

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**Conflicts of interest**

None disclosed.

**REFERENCES**

1. Dossett LA, Harrington M, Cruse CW, Gonzalez RJ. Cutaneous angiosarcoma. *Curr Probl Cancer*. 2015;39:258-263.
2. Conic RRZ, Damiani G, Frigerio A, et al. Incidence and outcomes of cutaneous angiosarcoma: a SEER population-based study. *J Am Acad Dermatol*. 2020;83:809-816.
3. Abdel-Rahman O. Prognostic impact of socioeconomic status among patients with malignant melanoma of the skin: a population-based study. *J Dermatolog Treat*. 2020;31:571-575.
4. Cheung MR. Using SEER data to quantify effects of low income neighborhoods on cause specific survival of skin melanoma. *Asian Pac J Cancer Prev*. 2013;14:3219-3221.
5. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat database, Version 8.3.6.1. Available at: http://www.seer.cancer.gov. Accessed June 1, 2020.

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