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RESEARCH LETTER

Disparities in Overall Survival in Patients with Melanoma by Race/Ethnicity, Socioeconomic Status, and Healthcare Systems

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Insurance status, a proxy for access to care, is an established correlate of cancer outcomes. Prior work in the field of healthcare disparities among melanoma patients, however, has included a mix of patients both with and without health insurance, making it difficult to disentangle the effects of various other sociodemographic factors.[1-5] In order to mitigate disparities and improve outcomes, we sought to independently examine the effects of these intertwined sociodemographic variables on all-cause mortality within an insured population of melanoma patients. Further, we aimed to evaluate the effects of health insurance coverage type, that is, whether patients were cared for within an integrated healthcare system or within a traditional model of healthcare, on all-cause mortality risk.

Our objective was to quantify the effect of race/ethnicity, socioeconomic status (SES) and healthcare system on overall mortality within an insured population of patients diagnosed with melanoma in Southern California from 2009 to 2014, and followed through 2017. Healthcare system was classified as those within Kaiser Permanente Southern California's (KPSC) network, a vertically integrated healthcare system, and insured patients outside of KPSC's network with other private insurance (OPI).

Using a retrospective cohort study design with data from the California Cancer Registry, we identified 14,614 adults diagnosed with melanoma (Stage 0-IV). The dataset included SES information based on geocoded data. The total number of deaths was 2,456 (16.8%) over a maximum follow up of 8 years. We examined person-year (PY) mortality rates and conducted Cox proportional hazard models, adjusted for age, sex, year of diagnosis, stage at diagnosis, race/ethnicity, SES, county of residence, and primary and adjuvant therapy.

Table 1. Demographic Characteristics of Patients Diagnosed with Melanoma between 2009-2014 in Southern California by Health Care System

	KPSC	OPI	Overall
	N (%)	N (%)	N (%)
Total	4701 (100%)	9913 (100%)	14614 (100%)
Age at time of melanoma diagnosis			
20-39 years	461 (9.8%)	1033 (10.4%)	1494 (10.2%)
40-64 years	2235 (47.5%)	4711 (47.5%)	6946 (47.5%)
65+ years	2005 (42.7%)	4169 (42.1%)	6174 (42.2%)
Sex			
Female	1942 (41.3%)	4061 (41%)	6003 (41.1%)
Male	2759 (58.7%)	5850 (59%)	8609 (58.9%)
Socioeconomic status (SES)			
Lowest SES	361 (7.7%)	510 (5.1%)	871 (6%)
Lower-Middle SES	662 (14.1%)	1077 (10.9%)	1739 (11.9%)
Middle SES	1033 (22%)	1736 (17.5%)	2769 (18.9%)
Upper-Middle SES	1389 (29.5%)	2556 (25.8%)	3945 (27%)
Highest SES	1256 (26.7%)	4034 (40.7%)	5290 (36.2%)
Race/Ethnicity			
Non-Hispanic White	3904 (83%)	8721 (88%)	12625 (86.4%)
Hispanic	521 (11.1%)	629 (6.3%)	1150 (7.9%)
Non-Hispanic Black	134 (2.9%)	89 (0.9%)	223 (1.5%)
Asian/Pacific Islander	80 (1.7%)	142 (1.4%)	222 (1.5%)
American Indian	10 (0.2%)	17 (0.2%)	27 (0.2%)
Other/Unknown	52 (1.1%)	315 (3.2%)	367 (2.5%)
County of Residence			
Imperial	1 (0%)	27 (0.3%)	28 (0.2%)
Los Angeles	1848 (39.3%)	3573 (36%)	5421 (37.1%)
Orange	764 (16.3%)	2481 (25%)	3245 (22.2%)
Riverside	546 (11.6%)	1080 (10.9%)	1626 (11.1%)
San Bernardino	386 (8.2%)	715 (7.2%)	1101 (7.5%)
San Diego	1156 (24.6%)	2037 (20.5%)	3193 (21.8%)
Stage at diagnosis			
I	3311 (70.4%)	6123 (61.8%)	9434 (64.5%)
II	529 (11.2%)	1383 (13.9%)	1912 (13.1%)
III	255 (5.4%)	837 (8.4%)	1092 (7.5%%)
IV	164 (3.5%)	432 (4.4%)	596 (4.1%)
Unknown	442 (9.4%)	1138 (11.5%)	1580 (10.8%)

KPSC, Kaiser Permanente Southern California; OPI, other private insurance.

Table 2. Overall Mortality Rates per 1000 Person-Years and Overall Mortality per Multivariate Adjusted Hazard Ratios by Health Care System Stratified by Age at Time of Melanoma Diagnosis, and Race/Ethnicity,* SES, and Stage of Melanoma

	KPSC			OPI			TOTAL		
	# deaths	Rate per 1000 PY (95% CI)	HR (95% CI)	# deaths	Rate per 1000 PY (95% CI)	HR (95% CI)	# deaths	Rate per 1000 PY (95% CI)	HR (95% CI)
Total	729	45.9 (42.7,49.4)	N/A	1727	53.6 (51.1,56.1)	N/A	2456	51.0 (49,53.1)	N/A
Age at time of melanoma diagnosis									
20-39 years	17	10.1 (5.9,16.1)	1 (ref)	55	15 (11.3,19.5)	1 (ref)	72	13.4 (10.5,16.9)	1 (ref)
40-64 years	157	19.8 (16.8,23.2)	1.75 (1.06,2.90)	386	24.4 (22,26.9)	1.61 (1.21,2.14)	543	22.8 (21,24.9)	1.63 (1.28,2.09)
65+ years	555	88.6 (81.4,96.3)	7.65 (4.67,12.51)	1286	101.1 (95.6,106.8)	6.21 (4.68,8.25)	1841	97.0 (92.6,101.5)	6.65 (5.21,8.49)
Race/Ethnicity									
Non-Hispanic White	626	46.9 (43.3,50.7)	1 (ref)	1558	54.6 (51.9,57.3)	1 (ref)	2184	52.1 (50,54.4)	1 (ref)
Hispanic	64	38.2 (29.4,48.8)	0.72 (0.54,0.95)	114	63.3 (52.2,76.1)	0.79 (0.64,0.96)	178	51.2 (44,59.3)	0.76 (0.65,0.9)
Non-Hispanic Black	25	62.1 (40.2,91.7)	0.87 (0.57,1.32)	19	66.3 (39.9,103.6)	1.00 (0.63,1.60)	44	63.9 (46.4,85.7)	0.92 (0.68,1.26)
Asian/Pacific Islander	13	56.1 (29.9,95.9)	0.95 (0.54,1.66)	29	71.4 (47.8,102.5)	1.24 (0.85,1.80)	42	65.8 (47.4,89)	1.12 (0.82,1.53)
American Indian	1	29.5 (0.7,164.3)	0.57 (0.08,4.08)	3	68.2 (14.1,199.4)	1.73 (0.43,6.94)	4	51.4 (14,131.5)	1.06 (0.34,3.29)
Other/Unknown				4	3.5 (0.9,8.8)	0.09 (0.03,0.25)	4	3.0 (0.8,7.7)	0.083 (0.03,0.22)
Socioeconomic status (SES)									
Lowest SES	69	57.7 (44.9,73.1)	1.47 (1.09,2.00)	137	96.4 (80.9,113.9)	1.80 (1.47,2.22)	206	78.7 (68.3,90.2)	1.70 (1.43,2.02)
Lower-Middle SES	103	47.5 (38.8,57.6)	1.40 (1.08,1.80)	264	77 (68,86.9)	1.50 (1.28,1.76)	367	65.6 (59,72.6)	1.47 (1.29,1.68)
Middle SES	164	46.5 (39.7,54.2)	1.28 (1.03,1.60)	348	64 (57.4,71.1)	1.39 (1.21,1.61)	512	57.1 (52.3,62.3)	1.36 (1.21,1.53)
Upper-Middle SES	210	44.3 (38.5,50.7)	1.15 (0.94,1.41)	422	50.1 (45.4,55.1)	1.19 (1.04,1.35)	632	48.0 (44.3,51.9)	1.19 (1.07,1.33)
Highest SES	183	43.1 (37.1,49.8)	1 (ref)	556	41.1 (37.8,44.7)	1 (ref)	739	41.6 (38.6,44.7)	1 (ref)
Stage at diagnosis									
I	293	24.8 (22.0,27.8)	1 (ref)	484	22.8 (20.8,25.0)	1 (ref)	777	23.5 (21.9,25.2)	1 (ref)
II	142	88.6 (74.6,104.4)	2.58 (2.10,3.16)	398	22.8 (20.8,25.0)	2.98 (2.60,3.41)	540	91.5 (83.9,99.5)	2.85 (2.55,3.19)
III	87	117.8 (94.3,145.3)	4.55 (3.54,5.84)	300	125.9 (112.0,140.9)	4.40 (3.79,5.11)	387	124.0 (111.9,136.9)	4.38 (3.86,4.97)
IV	114	460.7 (380.0,553.5)	13.34 (10.01,17.79)	320	507.9 (453.7,566.7)	10.54 (8.79,12.64)	434	494.6 (449.1,543.4)	11.28 (9.70,13.11)
Unknown	93	64.0 (51.7,78.4)	2.01 (1.57,2.56)	225	60.2 (52.6,68.6)	2.08 (1.77,2.45)	318	61.3 (54.7,68.4)	2.04 (1.79,2.34)

KPSC, Kaiser Permanente Southern California; OPI, other private insurance. * Insufficient power to determine statistical significance among Asian/Pacific Islanders and American Indians

Table 1 shows the distribution of demographics of the insured patients by healthcare system. KPSC had more minorities and those in the lowest two SES quintiles. Table 2 provides the PY all-cause mortality rates and multivariate adjusted hazard ratios (HR) by healthcare system. PY mortality rates by race/ethnicity did not yield significant results, possibly given the small numbers of deaths in certain populations. Mortality rates increased by decreasing SES quintile in the overall population. When stratifying by healthcare system, the PY mortality rates among those patients in KPSC were much more similar among SES groups, with the 95% confidence intervals (CI) overlapping for all five SES quintiles. By contrast, in OPI, the CIs for the lowest, lower-middle, and middle SES groups did not overlap with the CIs of the upper-middle and highest SES groups. Of note, the KPSC patients in the three lowest SES quintiles had statistically significant decreased mortality rates compared to their OPI counterparts.

In multivariable adjusted hazard models, we did not observe differences in mortality risk by race/ethnicity in either healthcare system, when using Non-Hispanic Whites as the reference population. We did appreciate an increased mortality risk by decreasing SES quintile in KPSC and OPI, when using the highest SES quintile as the reference population. This trend, however, was much more apparent in the OPI group. For example, the poorest patients in OPI had a mortality risk 80% greater than wealthiest patients in OPI (HR 1.80; 95% CI 1.47, 2.22), while the poorest patients in KPSC had a 47% greater risk than the wealthiest patients in KPSC (HR 1.47; 95% CI 1.09, 2.00).

In summary, our results suggest that disparities in overall mortality persist, even in a cohort with health insurance coverage, and that lower SES is an important driver of this disparity. We also underscore the survival advantages for those vulnerable populations cared for within an integrated healthcare network, such as KPSC.

Conflict of Interest Disclosures: None

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