

## Analysis of Melanoma in African American Patients in the United States

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**Abstract.** *Background/Aim:* To characterize the demographics, tumor staging and treatment of African American (AA) patients diagnosed with melanoma in the United States. *Patients and Methods:* The National Cancer Database was used to extrapolate data from patients with melanoma between January 1, 2004, and December 31, 2015. The patients were then further divided based on ethnicity (AAs vs. Caucasians) to compare patient efficacy of treatment. *Results:* The mean time for AA patients to receive treatment was 20.37 days compared with 11.25 days for Caucasians ( $p<0.001$ ), while time to surgery was 38.86 days compared to 31.12 days for Caucasians ( $p<0.001$ ). Moreover, AA race was a predictor of American Joint Committee on Cancer stage greater than II, tumor diagnosed at autopsy, presence of ulceration, and distribution in the extremities. *Conclusion:* AA patients with melanoma are more likely to have worse tumor staging, treatment delay, treatment at an Integrated Cancer Program, and diagnosis at autopsy.

African American's (AA) have a decreased likelihood of developing melanoma when compared to other ethnicities due to the protective action of melanin (1). The incidence of melanoma amongst AAs is 1 to 1.2 per 100,000 (2). However, melanoma in AA patients is frequently diagnosed at an advanced stage due to the difficulty in differentiating between skin tone and cancer combined with lower

socioeconomic levels (3, 4). In addition, melanoma survival is lower in AA patients undergoing surgical treatment compared to all other ethnicities (5). Etiologies of these disparities are difficult to assess and poorly understood (1-5). Treatment disparity in minority populations is a debated topic that deserves attention from the scientific community (6). In this study, we aimed to assess the difference in melanoma characteristics, patient population, tumor staging and treatment in AA compared to the Caucasian population. Furthermore, we speculated that significant differences exist between the two populations.

### Patients and Methods

This study was considered nonregulated by the institutional review board. The National Cancer Database (NCDB), an initiative driven by the American Cancer Society and the American College of Surgeons' Commission on Cancer that registers 70% of all cancers diagnosed in the USA, was used to extrapolate data (7, 8).

Eligible patients were identified according to the NCDB's variable "Race". Data were extracted for all patients diagnosed with melanoma between January 1, 2004, and December 31, 2015. The cohort was then split into two groups based on race: 1) AA or 2) Caucasian. Patients identified with others races, such as Asian or Native American, were excluded as this analysis focused on the comparison between AA patients and Caucasian patients, the largest cohort of patients with melanoma.

Data was extracted on patient demographics, facility/treatment type, and tumor characteristics. Patients demographics included age, sex, insurance (Uninsured, Private, Medicaid, Medicare, Other Government, Unknown), and population density (Metro, Urban, Rural, Unknown). Facility/treatment characteristics included facility type, region, days between diagnosis and treatment, and days to discharge (after most-definitive surgical procedure). Tumor characteristics included invasive behavior, Breslow depth, American Joint Committee on Cancer (AJCC) stage, and presence of ulceration.

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Table I. Patient demographic and clinical data by race.

Variable	Caucasians		African Americans		p-Value
	No	%	No	%	
Total	510,847	94.4%	3008	0.6%	
Mean age (SD)	61.57	16.102	60.92	16.992	0.001
Median age	63		62		
Age group					0.312
0-49	114,452	22.4%	696	23.1%	
50-59	101,347	19.8%	628	20.9%	
60-69	118,820	23.3%	660	21.9%	
70-79	104,517	20.5%	606	20.1%	
80+	71,711	14.0%	418	13.9%	
Gender					<0.001
Male	293,860	57.5%	1,276	42.4%	
Female	216,987	42.5%	1,732	57.6%	
Insurance status					<0.001
Not insured	10,739	2.1%	163	5.4%	
Private insurance	264,358	51.7%	1,228	40.8%	
Medicaid	11,495	2.3%	265	8.8%	
Medicare	207,582	40.6%	1,229	40.9%	
Other government	5,201	1.0%	42	1.4%	
Insurance status unknown	11,472	2.2%	81	2.7%	
Facility type					<0.001
Community cancer program	30,153.00	5.9%	168.00	5.6%	
Comprehensive community cancer program	168,401.00	33.0%	748.00	24.9%	
Academic/Research program	218,402.00	42.8%	1,380.00	45.9%	
Integrated network cancer program	41,554.00	8.1%	371.00	12.3%	
Missing	52,337.00	10.2%	341.00	11.3%	

p-Value was estimated by Chi-square or T-test.

Patient demographics, facility/treatment type, and tumor characteristics were described and analyzed using  $\chi^2$  or *t*-test, as appropriate. Multivariate analyses were performed using logistic regression models to assess independent associations, adjusting for confounders. Multiple analyses were conducted, setting as the outcome variable each facility type, tumor behavior, AJCC tumor stage and diagnosis at autopsy, and predicted variable of AA patients compared to Caucasians. The significance level was set at  $p < 0.05$ . Statistical analysis was done using SPSS 25.0 statistical software (SPSS Inc.).

## Results

A total of 513,855 patients met the inclusion criteria. The analyzed cohort included 3,008 AA patients (0.6%) and 510,847 Caucasians (99.4%). Table I outlines patient demographics and facility characteristics by tumor location. Melanoma in AA patients was significantly more prevalent amongst women and patients who were uninsured or insured by Medicaid ( $p < 0.001$ ). AA patients were found to receive treatment in Comprehensive Community Cancer Programs less frequently compared to Caucasian patients (Table I).

Tumor characteristics and treatment type separated by race are presented in Table II. Invasive behavior, Breslow depth greater than 1.01 mm, and tumor stage II to IV were more

prevalent in AA patients ( $p < 0.001$ ). Furthermore, AA patients had a higher frequency of melanomas on the extremities and decreased incidence on the head and neck and trunk ( $p < 0.001$ ). AA patients had a longer time between diagnosis and treatment and between surgery and discharge ( $p < 0.001$ ).

Using multivariate analysis (Table III), we noticed that AA patients had increased odds for melanoma with ulceration (OR=1.687; 95%CI=1.514-1.880;  $p < 0.001$ ), located in the extremities (OR=3.609; 95%CI=3.298-3.949;  $p < 0.001$ ), stage II (OR=1.350; 95%CI=1.299-1.403;  $p < 0.001$ ), stage III (OR=1.398; 95%CI=1.252-1.562;  $p < 0.001$ ), and stage IV (OR=2.6662; 95%CI=2.221-3.095;  $p < 0.001$ ). Moreover, AA patients had significantly higher odds of receiving the diagnosis at autopsy (OR=2.033; 95%CI=1.670-2.475;  $p < 0.001$ ) and being treated in Academic/Research Programs (OR=1.687; 95%CI=1.284-1.506;  $p < 0.001$ ) or Integrated Network Cancer Programs (OR=1.272; 95%CI=1.133-1.427;  $p < 0.001$ ).

## Discussion

Cutaneous melanoma is an aggressive cancer that can be deadly if not diagnosed and treated early. It has a higher incidence amongst the Caucasian population, however, in

Table II. Tumor characteristics by race.

Variable	Caucasians		African Americans		p-Value
	N	%	N	%	
Behavior					<0.001
<i>In situ</i>	127,910	25.0%	576	19.1%	
Invasive	382,937	75.0%	2,432	80.9%	
Breslow depth					<0.001
No mass/tumor found	15,915	3.1%	147	4.9%	
0.01-1.00 mm	206,576	40.4%	731	24.3%	
1.01-2.00 mm	68,449	13.4%	315	10.5%	
2.01-4.00 mm	42,004	8.2%	354	11.8%	
>4.00 mm	31,918	6.2%	492	16.4%	
Microinvasion or unknown	145,979	28.6%	969	32.2%	
Tumor's stage					<0.001
Stage 0	122,278	23.9%	548	18.2%	
Stage I	218,213	42.7%	653	21.7%	
Stage II	62,484	12.2%	606	20.1%	
Stage III	40,465	7.9%	457	15.2%	
Stage IV	20,948	4.1%	371	12.3%	
Stage unknown	46,459	9.1%	373	12.4%	
Ulceration					<0.001
No ulceration	383,832	75.1%	1,613	53.6%	
Ulceration present	63,234	12.4%	831	27.6%	
Unknown or missing	63,781	12.5%	564	18.8%	
Body region					<0.001
Head and neck	134,017	26.2%	323	10.7%	
Trunk	146,348	28.6%	371	12.3%	
Extremities	207,049	40.5%	1,986	66.0%	
Others (Non specified, overlapping lesion of skin)	23,433	4.6%	328	10.9%	
Treatment					<0.001
No treatment. Autopsy	25,420.00	5.0%	410.00	13.6%	
Receive treatment	485,427.00	95.0%	2,598.00	86.4%	
Days to treatment (SD)	11.25	27.68	20.37	41.00	<0.001
Days to any surgery (SD)	10.86	27.05	19.58	41.02	<0.001
Days to most effective surgery (SD)	31.12	35.35	38.86	48.57	<0.001
Days to discharge (SD)	1.69	9.13	2.85	10.92	<0.001

p-Value was estimated by Chi-square or T-Test. Missing data: Days to treatment (5.6% White; 9.7% Black); Days to any surgery (7.4% White; 14.1% Black); Days to most effective surgery (8.7% White; 16.7% Black); Days to discharge (17.1% White; 24.9% Black).

rare instances, it also occurs in AA patients (1). Due to the low incidence of melanoma in AAs diagnosis and treatment is often delayed. Moreover, most public health educational campaigns target causation patients (9). Educating patients and physicians is a critical component to increasing awareness of total skin evaluations especially amongst AAs where they maybe underutilized; these have been shown to be an effective tool at detecting melanoma earlier (10).

Understanding the diversity of presentation amongst different ethnicities for melanoma is fundamental to achieving an early diagnosis and effective treatment. The significance of this study is that it contributes to understanding the demographic and socioeconomical characteristics of this disease and sheds light on treatment disparities between AAs and Caucasian patients.

Our study demonstrated that the age distribution of melanoma among AA and Caucasian patients is similar. However, there is a higher proportion of AA females compared to males; while the contrary is true for Caucasians.

Patients with a lower socioeconomic status are more likely to be diagnosed at advanced stages of melanoma and therefore have a higher mortality (11). Linos *et al.* studied 29,792 patients with melanoma from California and reported that patients with a lower socioeconomic status were more likely to present with a Breslow depth greater than 4 mm (11). A similar study by Chang *et al.* showed that a lower socioeconomic status was associated with a lower 5 year mortality even when stratifying for stage at diagnosis (12).

Our results showed that AAs have melanoma that is more likely to be located in the extremities compared to Caucasians

Table III. Odds of facility type, tumor stage, behavior, ulceration, located in extremity and diagnosis at autopsy for African American patients compared to Caucasians.

Variable	95%CI			p-Value
	OR	Lower	Upper	
Academic/Research program				
AA vs. Caucasian (ref)	1.39	1.284	1.506	<0.001
Community cancer program				
AA vs. Caucasian (ref)	0.870	0.741	1.021	0.089
Comprehensive community cancer program				
AA vs. Caucasian (ref)	0.632	0.579	0.691	<0.001
Integrated network cancer program				
AA vs. Caucasian (ref)	1.272	1.113	1.427	<0.001
Diagnosis at autopsy				
AA vs. Caucasian (ref)	2.033	1.670	2.475	<0.001
In situ				
AA vs. Caucasian (ref)	1.047	0.811	1.351	0.724
Invasive				
AA vs. Caucasian (ref)	0.955	0.740	1.233	0.724
Stage 0				
AA vs. Caucasian (ref)	0.965	0.621	1.498	0.873
Stage I				
AA vs. Caucasian (ref)	0.381	0.340	0.427	<0.001
Stage II				
AA vs. Caucasian (ref)	1.350	1.299	1.403	<0.001
Stage III				
AA vs. Caucasian (ref)	1.398	1.252	1.562	<0.001
Stage IV				
AA vs. Caucasian (ref)	2.622	2.221	3.095	<0.001
Ulceration				
AA vs. Caucasian (ref)	1.687	1.514	1.880	<0.001
Location - Body's extremity				
AA vs. Caucasian (ref)	3.609	3.298	3.949	<0.001

Logistic regression models adjusted for variables related to patient demographics, tumor, and facility. AA: African American; CI: confidence interval.

that have higher distribution in the trunk, head and neck. The location of cutaneous melanoma can be significant when it comes to the initial identification and earlier diagnosis. While moles on the face and trunk may be more easily identified, acral locations can make diagnosis more challenging for physicians and patients. The location of melanoma in AAs could be a contributing factor to the delay in diagnosis. In a study conducted by Cormier *et al.* (13), AAs were found to have the worst prognosis when compared to white patients and other minorities (13). They also found that AAs had a 4-fold higher risk of being diagnosed at stage IV disease and were 1.5x more likely to die due to melanoma than white patients (13). This is congruent with our results that show that AA patients were more likely to present at advanced stages of disease when compared to white patients, even when adjusting for cofounders.

The most common and effective treatment for patients diagnosed with cutaneous melanoma is surgical resection of the lesion (14). Our results showed that AAs are less likely

to receive treatment with an increased number of days to surgery. This is in concordance with the results found by Mahendraraj *et al.* (1), in which they found that AAs were less likely to receive surgical resection when compared to white patients (1). Moreover, a previous study that enrolled 151,154 patients diagnosed with cutaneous melanoma showed that white patients were more likely to receive appropriate surgical treatment compared to AAs (94.5% vs. 86.6%,  $p<0.05$ ) (5).

The authors recognize several limitations to this analysis. Due to incomplete data of the NCDB we were unable to include histologic subtype and tumor mitotic index. The accuracy of the data found on the database is subject to the accuracy of centers reporting. Wrong input of data can potentially confound significant associations identified. Future directions for research in melanoma are warranted to fully explore which demographic factors are associated with late-stage diagnosis, considering education level, socioeconomic status, and insurance coverage as potential contributing factors.

In conclusion, AAs have significantly higher odds of being diagnosed at a later stage of disease, ulceration, treatment delay and have melanoma located in the extremities. We hope these findings can help guide future multi-institutional studies to design diagnostic and treatment algorithms for patient-specific melanoma care and shed light on the discrepancies that exist.

### Conflicts of Interest

The Authors have no conflicts of interest to declare regarding this study.

### Authors' Contributions

All Authors contributed to the study design, commented on previous versions of the manuscript, read and approved the final manuscript. Material preparation, data collection and analysis were performed by DJR, ACS and AJF. The first draft of the manuscript was written by DJR and DB.

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