SKIN

ORIGINAL RESEARCH

Socioeconomic Factors in the Diagnosis and Treatment of Malignant Melanoma in Hispanic vs. Non-Hispanic Patients: A National Cancer Database (NCDB) Study

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ABSTRACT

Background: The incidence of melanoma is rapidly increasing in the United States. There is a paucity of research of how melanoma affects the Hispanic population, the quickest growing population.
Objective: To identify and understand how socioeconomic factors affect a Hispanic patients health outcome and treatment of malignant melanoma with comparisons to white, non-Hispanic (WNH) patients.
Methods: A retrospective study utilizing the National Cancer Database (NCDB) was completed investigating Hispanic patients (n=2282) and WNH patients (n=190,469) with Stage I-IV malignant melanoma. Outcome and socioeconomic variables were identified and compared across groups. Data was analyzed with SPSS and SAS Statistical Software; Kaplan-Meier survival curves and Cox Proportional Hazard Regression Models were computed.
Results: Hispanic patients have 2.50 higher odds of being diagnosed with Stage IV vs. Stage I melanoma when compared to WNH patients (95% CI 2.20-2.86, $p<0.001$). Differences in insurance status, income, education, facility type, facility location, urban/rural, Charlson-Deyo score, and stage are all statistically significant for WNH compared to Hispanic patients ($p<0.05$).
Conclusion: In addition to various socioeconomic disparities, Hispanic patients are more likely than WNH patients to have melanoma diagnosed at higher stages and subtypes with worse prognosis. Clinicians need to provide skin cancer education and prevention and mobilize resources to serve this diverse population.

INTRODUCTION

Skin cancers are the most common cancers in the United States and worldwide, with an estimated annual cost of treating skin cancers about $8.1 billion.[1] While basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) are the most common, the incidence of melanoma, the most lethal form of skin cancer, diagnosed annually increased by 27% over the past decade (2003-2023). In 2023, it is estimated that 186,680 cases of melanoma will be diagnosed, of which 97,610 cases will be invasive.[1] Localized melanoma has an excellent prognosis, with five-year

overall survival (OS) rates of 99% for local disease. This decreases with advanced stage, with a 5-year OS of 66% if spread to regional lymph nodes and 27% if metastatic.[2]

Melanoma disproportionately affects men more than women; it is predicted that in 2021 62,260 men and 43,850 women were affected with invasive melanoma.[1,3] In addition to gender, melanoma more commonly affects Caucasians, with the lifetime risk of melanoma of about 1 in 38 for Caucasians, 1 in 167 for Hispanics, and 1 in 1,000 for African Americans.[4] Melanoma affects people of color differently as it is often diagnosed in atypical locations as thicker, more advanced melanomas with more regional involvement which leads to worse prognoses.[5-9] As patients of Hispanic ethnicity are among the fastest growing population in the United States, and there is a paucity of data about disease specific factors in this ethnic group, it is vital to identify the incidence and disparities regarding the diagnosis and treatment in this population.[10]

As with other underserved ethnic groups, Hispanic patients tend to present with later stage disease and a higher risk for regional involvement compared to Caucasian patients.[5-9] In fair-skinned Hispanics, melanomas may be more likely to be found on the trunk and legs; in dark-skinned Hispanics melanomas are more likely to be found on the feet.[8] Females tend to present with melanoma on the lower limb and hip while males tend to present with melanoma on the trunk.[9] Additionally, the most common forms of melanoma in Hispanic patients include superficial spreading melanoma, acral lentiginous melanoma, and nodular melanoma, which have poorer outcomes.[9]

Although there are data using the National Cancer Database (NCDB) informing the socioeconomic factors and disparities, to our knowledge, this is the first study to address melanoma specifically in the Hispanic population. In this study, we aim to identify socioeconomic factors that affect a Hispanic patient's health outcomes and treatment of malignant melanoma with comparisons to white, non-Hispanic (WNH) patients.

METHODS

Utilizing the NCDB, a nationwide clinical oncology outcomes database, we retrospectively analyzed the data to determine the socioeconomic factors associated with diagnosis and treatment of invasive melanoma in Hispanic patients (n=2282) versus WNH patients (n=190,469). Our definition of Hispanic includes people of Latino and Spanish origin. Patients with confirmed malignant melanoma were identified by ICD-0-3 histology.

Outcome and socioeconomic variables were analyzed, including age, American Joint Committee on Cancer (AJCC) stage groups I-IV, Spanish Hispanic origin, and race, primary payor at diagnosis, Charlson-Deyo score, zip code level median household income, zip code level education, facility type, urban/rural, and facility location.

Patients were excluded for missing or incomplete data with certain variables as shown in **Figure 1.** If the data was coded as blank/not available, the cases are labeled “Variable Value Missing.” If the data was coded as unknown then the cases are labeled “Variable Value Unknown.”

AJCC Clinical Stage group only included Stage I-IV because this analysis investigated invasive or malignant melanoma; not melanoma in situ/Stage 0. The data was analyzed using SPSS and SAS Statistical Software. Analysis was completed

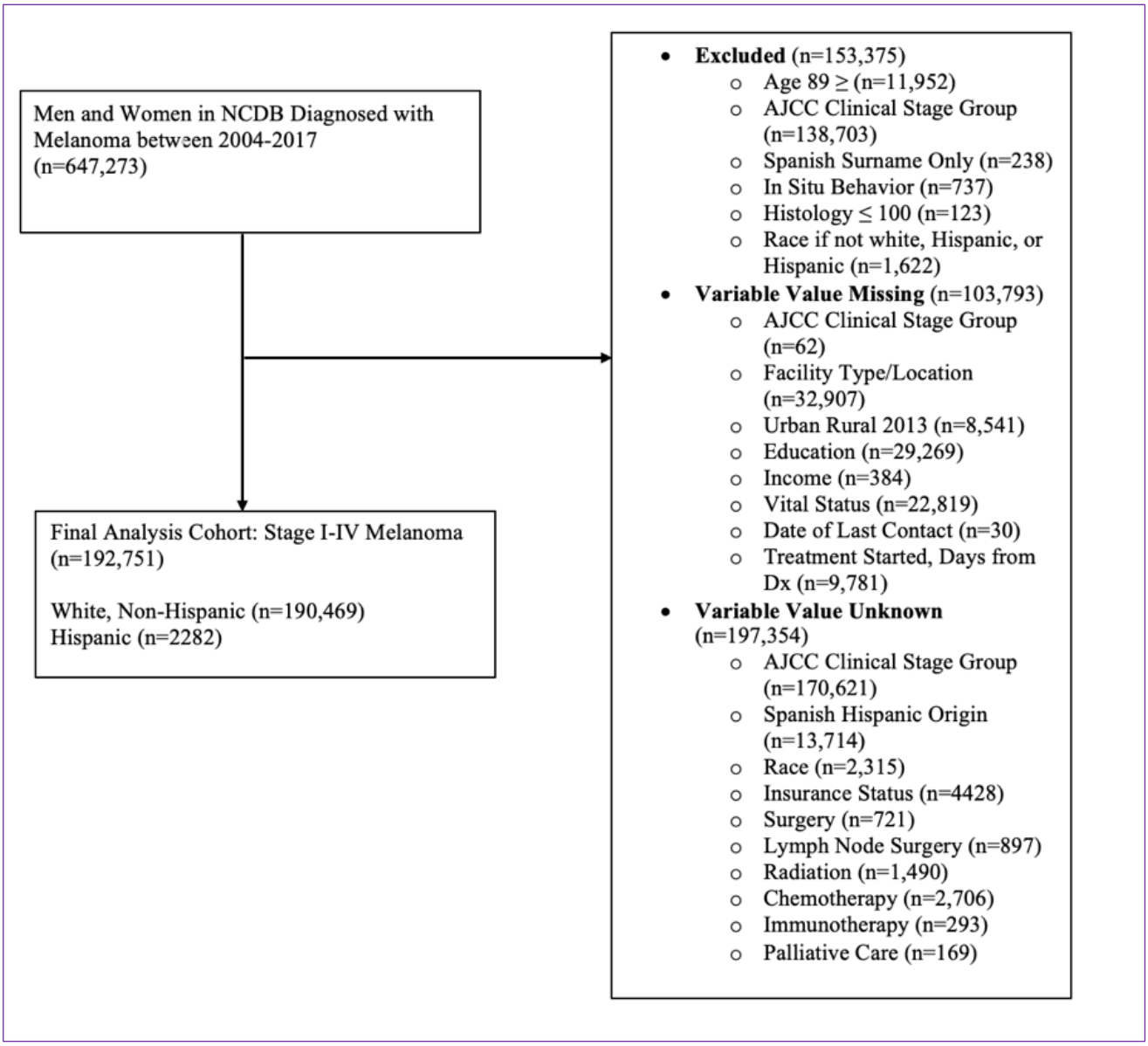

Figure 1. Description of included and excluded variables.

of demographic and socioeconomic variables assessing percentages and p-values.

Kaplan-Meier survival curves were plotted to estimate overall survival. Multivariable analyses was performed with Cox Proportional Hazard Regression Models to estimate the independent effect of patient characteristics after controlling for other co-variates. The variables included were chosen to evaluate how socioeconomic factors and treatment options influence health outcomes. The proportionality of hazards assumption was examined with log-negative-log survival plots and time-dependent coefficients were used to determine if there was an interaction between time and each variable of interest. The functional form of age was investigated with plots of Martingale residuals, and we accommodated for the clustering of patients within a facility with a robust sandwich covariance estimator.

RESULTS

A total of 192,751 documented cases of melanoma between 2004-2017 are included. Of these patients, there are 2,282 Hispanic patients and 190,469 WNH patients. **Table 1** summarizes the baseline patient characteristics. About 9.3% of Hispanic patients were uninsured and 10.9% were on Medicaid, compared to 1.9% and 2.3% of WNH patients, respectively. Hispanic patients were more likely than WNH patients to live in zipcodes with lower annual income and lower rates of high school graduates. Higher stages (stage III and IV) were more common in WNH patients than Hispanic patients. Hispanic patients have some 2.50 higher odds being diagnosed with Stage 4 vs. Stage 1 when compared to WNH patients (95% CI 2.20-2.86, p<0.001).

Differences in insurance status, income, education, facility type, facility location, urban/rural, Charlson-Deyo score, and stage are all statistically significant for WNH compared to Hispanic patients (p<0.05).

Both Hispanic and WNH patients were primarily male with an average age of 61 and 64 years, respectively. Approximately 16% of WNH and 19% of Hispanic patients had a Charlson Deyo comorbidity score of 1 or above, and most received treatment at an academic/research program in a metro area. Hispanics were more likely to receive treatment in the Pacific and South Atlantic while WNH patients were more likely to receive care in the South Atlantic and Middle Atlantic.

WNH patients were more likely to be diagnosed with stage I disease compared to Hispanic patients (68% vs 53%), while Hispanic patients were more likely to be diagnosed with metastatic disease (12% vs 6%) as shown in **Table 1**.

WNH patients had higher incidences of lentigo maligna melanoma (6.1% vs. 2.7%) and superficial spreading melanoma (32.1% vs. 21.3%) compared to Hispanics. Also, Hispanics had a higher percentage of acral lentiginous melanoma compared to WNH individuals (8.5% vs. 1.1%).

The most common primary sites (anatomic site of origin for the cancer) for diagnosis of melanoma had different prevalence for the WNH and Hispanic groups. WNH patients more commonly had melanoma diagnosed on skin of trunk (30.6%), skin of upper limb and shoulder (25.3%), and skin of lower limb and hip (16.8%). Meanwhile, Hispanics more commonly found melanoma on the skin of lower limb and hip (31.6%), skin of trunk (22.4%), and skin of upper limb and shoulder (17.7%).

Table 1. Demographic and clinical characteristics stratified by ethnicity.

	WNH	Hispanic	p
Patients	190,469	2,282	-
Age	64 [54-74]	61 [51-72]	<.001
Biological Sex			<.001
Female	39.2	45.3	
Male	60.8	54.7	
Insurance Status			<.001
Uninsured	1.9	9.3	
Private	50.4	45.1	
Medicaid	2.3	10.9	
Medicare	44.4	34.4	
Other Government	1.1	0.4	
Zip Code-Level Income Quartile			<.001
<$38,000	10.0	16.8	
$38,000-$47,999	20.3	22.4	
$48,000-$62,999	27.3	28.9	
≥$63,000	42.4	31.9	
Zip Code-Level Education (No High School Diploma)			<.001
≥21.0%	9.0	35.6	
13.0%-20.9%	21.1	22.9	
7.0%-12.9%	35.6	22.6	
<7.0%	34.3	19.0	
Stage			<.001
1	68.3	53.0	
2	20.6	24.7	
3	4.7	10.0	
4	6.3	12.2	
Charlson-Deyo Score			<.001
0	84.1	9.1	
1	12.3	6.5	
2	2.5	9.6	
3	1.0	0.8	
Facility Type			<.001
Community Cancer Program	5.8	4.3	
Comprehensive Community Cancer Program	34.1	27.3	
Academic/Research Program	49.9	59.2	

Integrated Network Cancer Program	10.2	9.3	
Urban/Rural			<.001
Metro	85.1	95.5	
Urban	13.3	4.1	
Rural	1.6	0.5	
Facility Location			<.001
New England	6.7	3.1	
Middle Atlantic	16.8	14.0	
South Atlantic	23.0	24.7	
East North Central	16.6	9.2	
East South Central	6.2	1.7	
West North Central	8.8	2.2	
West South Central	4.3	11.4	
Mountain	4.5	6.6	
Pacific	13.1	27.0	

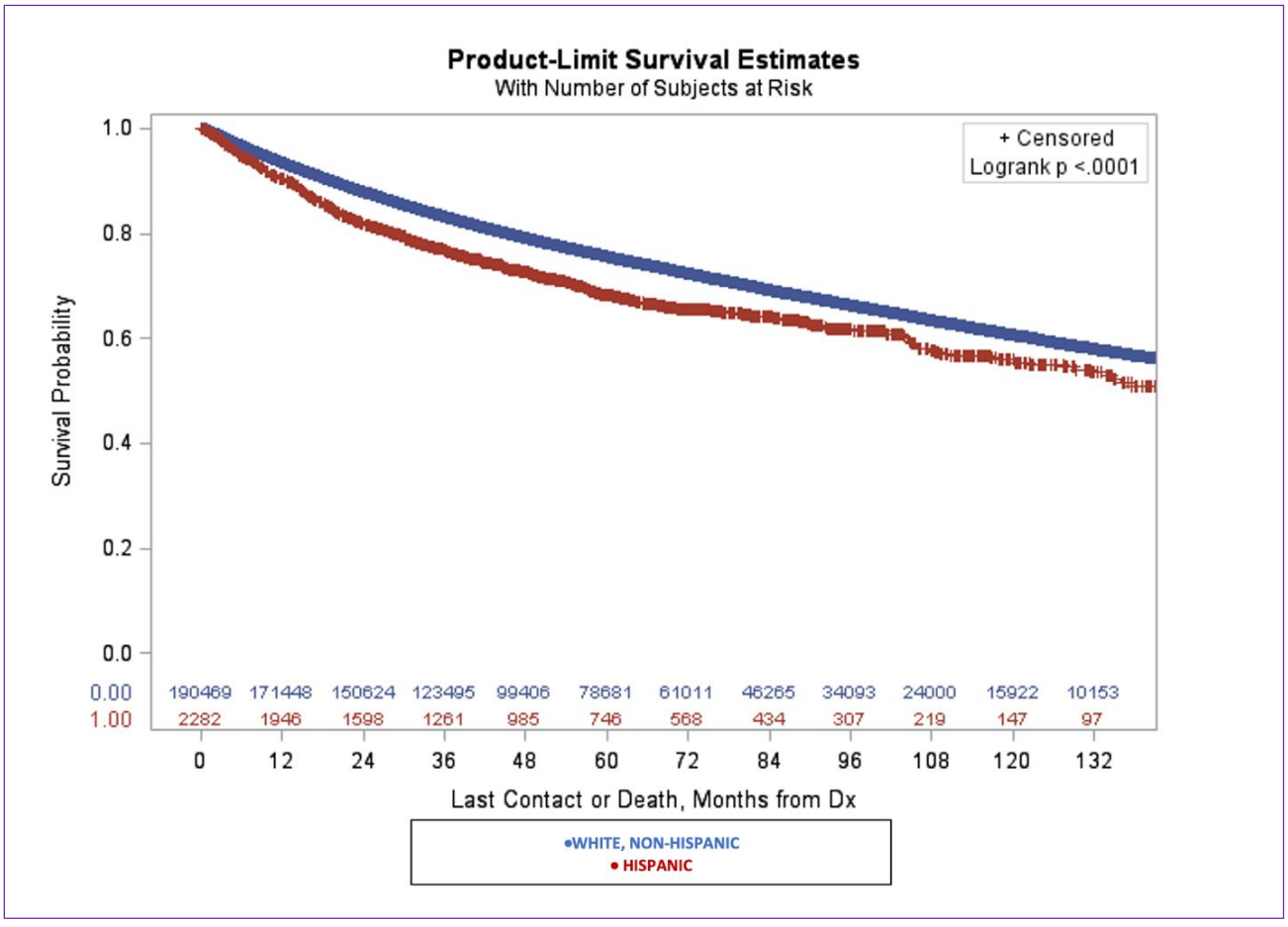

Figure 2. Kaplan Meier curve for WNH vs. Hispanic patients with melanoma.

In addition, Kaplan Meier curves were created to analyze the survival outcomes of WNH and Hispanics seen in **Figure 2**. Unadjusted survival was initially seen via the log-rank test ($P < .001$). As shown in **Table 2**, WNH have higher survival rates at 3, 5, and 10 years compared to Hispanics.

Lastly, a multivariable Cox regression model was estimated to assess risk of mortality differences associated with ethnicity. These results are shown in **Table 3**.

This statistical analysis demonstrates that there are many significant differences between WNH and Hispanic melanoma diagnoses, treatment modalities, socioeconomic factors, and survival outcomes.

DISCUSSION

To date, our study is the first using the NCDB to determine health disparities in the rapidly growing Hispanic ethnic group.

Our data suggest that, on average, Hispanic patients are diagnosed with higher stages of melanoma than WNH patients. Specifically, Hispanic patients have 2.50 higher odds of being diagnosed with Stage IV vs. Stage I when compared to WNH patients (95% CI 2.20-2.86, p<0.001). There are likely multifactorial reasons for this, with factors such as poor language proficiency, low health literacy, diminished trust in the healthcare system, limited accessibility to healthcare resources, and no previous established PCP relationships contributing to later staging of a melanoma diagnosis.[6-10] In our analysis, factors such as income, education, and insurance status contributed to more advanced and later diagnosis. This is significant, as higher stage is linked to poorer outcomes and overall survival.[6-12] Similarly, our data found that more Hispanic patients were treated at academic centers compared to WNH patients. The factors for this are likely multifactorial, such as transportation, concentration of cancer treating facilities, or rates of melanoma in certain regions, among other variables.[6-12] These results exemplify that strategies may need to be implemented to diagnose melanoma earlier in Hispanic patients.

Our study found that Hispanic patients are diagnosed at later stages than WNH patients, with approximately 12.3% of Hispanic patients diagnosed at stage IV compared to 6.3% of WNH patients. This translates to a difference in survival, with WNH patients having higher survival rates than Hispanics.

In **Table 3** it is interesting to note, although not statistically significant (p=0.358) that the hazard ratio (HR) for Hispanic vs. WNH patients indicates that Hispanics had a 4% lower risk of death. Thus, the HR demonstrates that a greater risk of death is associated with higher stage, greater age, Medicaid (vs. Private Insurance), lower income, and lower education level (p<.001).

Of note, immune checkpoint inhibitors (anti-CTLA4, anti-PD-1, and anti-PD-L1) and targeted therapy (BRAF and MEK inhibitors) have been major advances in the treatment of melanoma in the last ten years. Although, the use of immunotherapy in our study was not statistically significant it is estimated that the new drugs were likely not used until 2013-2016, and our data set analyzed patients from years 2004-2017.[13,14]

Our results are similar to previous studies in that Hispanic patients have statistically

Table 2. Survival rates between WNH and Hispanic patients at 3, 5, and 10 years.

	Survival Rates	
	WNH	Hispanic
3-year	83.2 (83.0-83.4)	76.7 (74.8-78.5)
5-year	75.6 (75.4-75.8)	68.3 (66.0-70.4)
10-year	60.7 (60.3-61.0)	55.7 (52.5-59.1)

Table 3. Multivariable Cox regression model assessing risk of mortality differences between WNH and Hispanic patients.

	HR	Lower Confidence Limit	Upper Confidence Limit	*P*
Ethnicity				
Non-Hispanic vs. Hispanic	0.96	0.87	1.05	0.358
Age (per 10 years)	1.67	1.64	1.70	<.001
AJCC Clinical Stage				
Stage 2 vs. Stage 1	2.38	2.30	2.45	<.001
Stage 3 vs. Stage 1	3.54	3.38	3.71	<.001
Stage 4 vs. Stage 1	9.86	9.30	10.45	<.001
Payor Status				
None vs. Private	1.80	1.66	1.96	<.001
Medicaid vs. Private	2.19	2.03	2.36	<.001
Medicare vs. Private	1.19	1.16	1.23	<.001
Other Government vs. Private	1.19	1.05	1.35	0.006
Zip Code-Level Median Household Income				
38,000-47,999 vs. < 38,000	0.92	0.88	0.95	<.001
< 48,000-62,999 vs. < 38,000	0.89	0.85	0.93	<.001
≥ 63,000 vs. < 38,000	0.80	0.75	0.86	<.001
Zip Code-Level Education (No High School Diploma)				
≥ 21 vs. < 7	1.11	1.03	1.19	0.008
13-20.9 vs. < 7	1.10	1.05	1.16	<.001
7-12.9 vs. < 7	1.10	1.06	1.14	<.001
Chemotherapy				
Yes vs. No	1.84	1.72	1.97	<.001
Radiation				
Yes vs. No	1.85	1.76	1.95	<.001
Immunotherapy				
Yes vs. No	1.04	0.99	1.10	0.119

similar risk of death with a shorter time-to-death. Hispanics have higher prevalence of melanoma diagnoses associated with poorer outcomes (acral lentiginous melanoma) and more advanced disease.[6,7,9] The location of discovered cancer varies between WNH and Hispanic patients, but both groups show high rates of melanoma being diagnosed on the skin of trunk, skin of upper limb and shoulder, and skin of lower limb and hip which is consistent with the study by Erin Garnett et al.[9] Cultural barriers, less frequent dermatology exams, a lack of knowledge of preventative skin cancer measures, or ability to monitor lesions due to difficult locations may lead to worse prognoses and higher stages in Hispanic patients.[6-12]

Our study, while the findings are important, has limitations worth discussing. Although, the NCDB is recognized as a comprehensive database, it does not include patient data diagnosed at non-Commission on Cancer (CoC)-accredited facilities; it only includes about 70% of cancer patients. Thus, it is not known if non-CoC patient data is consistent with NCDB CoC patient data. Another limitation of this study was that there were biases inherent of large database reviews including incorrect coding of data; we excluded 301,147 patients due to missing or unknown data. The retrospective nature of the study limited us to the variables documented by NCDB. Lastly, the NCDB does not record cancer-specific survival, so we are unable to differentiate between melanoma-specific mortality and all-cause mortality. Despite these limitations, our results are consistent with those found in the published literature which supports our conclusions.

Our study supports the findings that outcomes for Hispanic patients diagnosed with melanoma are inferior to those in WNH populations. As the Hispanic population is one of the most rapidly growing groups in the US, it is important to take a multi-factorial and multi-disciplinary approach to address these disparities. First, there is a need for new and critical research to better understand major causes of advanced melanoma among Hispanic patients. Diverse sample populations are needed to evaluate genetic, socioeconomic, and behavioral risk factors. Hispanic patients should also be included on all major trials investigating new treatment options for melanoma. Secondly, community efforts are vital to create an increased awareness of skin cancer, decrease incidence, increase diagnosis, and improve outcomes. While ensuring cultural competence and language accessibility, primary care physicians and dermatologists must educate Hispanic patients about skin cancer risk factors, how to identify abnormal lesions, and how to conduct self-skin exams.[12]

CONCLUSION

Melanoma's incidence is rapidly increasing, just as the Hispanic population is the most dramatically growing demographic group in the United States. Minimal melanoma research has been conducted among diverse populations. We identified several factors associated with poor health outcomes and a malignant melanoma diagnosis for Hispanic patients compared to WNH patients. Hispanic patients are more likely than WNH patients to have more advanced disease diagnosed at higher stages and melanoma subtype associated with poorer prognosis. Additionally, they are more likely to be uninsured and have lower income and education levels which may contribute to lower 3-, 5-, and 10-year survival rates compared to WNH patients. These conclusions increase our competence of health disparities affecting Hispanic patients

and exemplify that we must mobilize resources to reach vulnerable populations, complete melanoma research among diverse populations, and educate patients about skin cancer to address this growing public health concern.

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