Title

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Disparity in initiation of checkpoint inhibitors among commercially insured and Medicare Advantage patients with metastatic melanoma

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Plain language summary

Patients with advanced melanoma living in areas with a greater minority population are more likely to have delays in the start of their cancer treatment. This study adds important information that could inform medication use strategies to help improve health outcomes and equity.

Implications for managed care pharmacy

Our study adds valuable information that could be used to guide the development of medication use strategies (eg, targeted provider interventions, patient mailings, patient advocacy), as well as further emphasizing the significant health care inequalities present in the United States. Increased awareness of the factors driving use or delayed initiation of immunotherapy treatment can help overcome sociodemographic disparities in melanoma outcomes.

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ABSTRACT

BACKGROUND: Immune checkpoint inhibitors (ICIs) have revolutionized the treatment of advanced melanoma, but racial disparities in melanoma outcomes continue. These inequities are not fully explained by individual factors.

OBJECTIVE: To investigate the associations of neighborhood factors with the use of ICIs in metastatic melanoma.

METHODS: We conducted a retrospective cohort study of commercially insured US adults with metastatic melanoma diagnosed between January 2011 and December 2020. We examined the associations between the county-level percentage of population from racial and ethnic minority groups and the time from metastatic melanoma diagnosis to initiating ICIs using Cox proportional hazards models adjusting for patient characteristics.

RESULTS: We identified 4,052 patients with metastatic melanoma, of which 49% used ICIs. We found that the adoption of ICIs in a county declined with increasing minority quintile (quintile 1: 52.4%, quintile 2: 50.4%, quintile 3: 50.1%, quintile 4: 45.8%, and quintile 5: 44.7%). The delay in ICI initiation also went up as the percentage of minorities in a county increased (log-rank test $P = 0.03$). Compared with the lowest quintile, the adjusted hazard ratio of ICI initiation of the second, third, fourth, and highest minority quintile was 0.94 (95% CI = 0.81-1.08), 0.88 (95% CI = 0.76-1.02), 0.81 (95% CI = 0.68-0.97), and 0.77 (95% CI = 0.66-0.91), respectively. Secondary analysis revealed that the slower initiation was driven by the counties with the highest percentage of Hispanic population (hazard ratio = 0.74; 95% CI = 0.61-0.89)

in both Cox models and sensitivity analyses. High-minority counties correlated with metro areas, higher poverty levels, and a greater number of medical oncologists.

CONCLUSIONS: We found that patients with metastatic melanoma living in counties with higher proportion of minorities, particularly of Hispanic origin, are more likely to experience delays in ICI treatment. This study provides important population-level data on neighborhood-level disparity in medication use. More research is needed on the underlying provider- and system-level factors that directly contributed to the lower use of cancer medicines in high-minority areas, which can help inform the development of evidence-based medication use strategies that can improve health outcomes and equity.

Melanoma is responsible for 9,000 yearly skin cancer deaths in the United States and its incidence is increasing.[1] The estimated annual productivity loss attributed to melanoma is $3.5 billion.[2,3] Almost 100,000 US adults are projected to be diagnosed with invasive melanoma in 2023 alone and roughly 5% will be diagnosed at distant/metastatic stage,[4] which accounts for the vast majority of skin cancer deaths.[5] Immune checkpoint inhibitors (ICIs) have revolutionized the treatment of metastatic melanoma since their approval in 2011, increasing the number of patients who achieve long-term remission from 10% to 50%.[6] ICIs have been shown to provide significant survival benefits across diverse demographic groups and are now standard of care for patients with metastatic melanoma, as well as earlier stages of disease.[7-9]

Significant disparities in skin cancer detection, treatment, and survival exist among racial and ethnic minorities.[10-12] Although the widespread use of ICIs has led to a decrease in overall melanoma-related mortality, there is evidence that this benefit disproportionately favors non-Hispanic White patients, widening the racial gap in melanoma survival.[13,14] Hispanic and Black patients with melanoma are more commonly diagnosed at advanced stages compared with non-Hispanic White patients with melanoma, and any potential disparity in ICI use is a public health concern.[15] Prior studies have attributed these differences primarily to individual socioeconomic factors, such as insurance status or income, especially given the high cost of ICIs.[13] However, the melanoma survival gap persists even when controlling for such confounders.[13] Others have suggested that the inequities in ICI use might be due to personal attributes, such as age or comorbidity status, provider experience and cultural competency, and treatment team diversity.[13,16] However, no study has been able to fully explain the observed disparities.

Although individual-level determinants of health have been well studied, less is known about the impact of the neighborhoods patients reside in. There is growing evidence that neighborhoods are key determinants of health.[17] The effects of racial and ethnic density on outcomes have been previously studied, but with inconsistent findings. Some suggested that minority density is detrimental to health, whereas others showed protective effects of high ethnic density attributed to social cohesion and health-promoting behaviors.[18-20] Understanding how neighborhood characteristics can affect melanoma treatment could guide public health interventions and medication use strategies aimed at decreasing cancer disparities. To our knowledge, no existing studies on disparate ICI uptake in melanoma has considered neighborhood contexts. Here, we investigate the association of neighborhood factors with disparities in the initiation of ICIs among adult commercially insured and Medicare Advantage enrollees with metastatic melanoma.

Methods

This retrospective cohort study was performed and reported in accordance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Reporting Guidelines.[21]

DATA AND STUDY POPULATION

We conducted a retrospective cohort study using the deidentified Optum Clinformatics Data Mart. The Optum database is a large, adjudicated claims database that covers working-age adults and their dependents with commercial insurance and older adults with Medicare Advantage, with a total annual enrollment between 15 and 20 million.[22] Patients in Optum have both medical and pharmacy coverage, allowing the analysis of overall use of cancer drugs.

We identified patients aged 18 years and older with newly diagnosed metastatic melanoma between January 2011 and December 2020 using the *International Classification of Diseases, Tenth Revision, Clinical Modification* versions 9 and 10 codes (Supplementary Table 1, available in online article). Patients were required to have at least 1 inpatient claim with a diagnosis in any field of melanoma or at least 2 outpatient claims with a diagnosis in any field of melanoma that occurred at least 30 days apart, between January 2011 and December 2019 (identification period). Their first diagnosis of melanoma in the identification period was defined as the index date. To identify metastatic cancer, patients were required to have at least 2 medical claims with a diagnosis in any field of secondary metastasis on separate dates, within 30 days before or any time after the index date. The date of the first claim of secondary metastasis in this period was considered the date of the metastatic diagnosis. Patients were excluded if they had a claim with a diagnosis of any other cancer in the year prior

TABLE 1 Characteristics of Patient Population

	All N = 4,052	By minority quintiles				
		1	2	3	4	5
Age, mean (SD), years	68.7 (14.0)	68.8 (13.8)	68.8 (13.7)	67.9 (14.3)	69.7 (13.8)	68.7 (14.4)
Female, n (%)	1,478 (36.5)	290 (35.5)	291 (35.5)	307 (38.3)	306 (36.9)	284 (36.3)
Living in a metro county, n (%)	3,550 (87.6)	527 (64.4)	742 (90.5)	747 (93.3)	779 (94.0)	755 (96.4)
Percentage of population under poverty, mean (SD)	13.2 (4.7)	11.5 (4.8)	11.8 (3.8)	12.6 (4.1)	14.8 (4.6)	15.5 (4.6)
Number of medical oncologists in the county, mean (SD)	4.7 (4.8)	2.8 (3.9)	3.9 (5.4)	5.1 (3.8)	5.8 (3.7)	5.8 (3.8)
Charlson comorbidity score, n (%)						
0	1,721 (42.5)	364 (44.4)	347 (42.3)	356 (44.4)	339 (40.9)	315 (40.2)
1-2	889 (21.9)	196 (23.9)	175 (21.3)	180 (22.5)	186 (22.4)	152 (19.4)
≥3	1,352 (33.4)	248 (30.3)	279 (34.0)	243 (30.3)	286 (34.5)	296 (37.8)
Medicare Advantage, n (%)	2,578 (63.6)	518 (63.3)	525 (64.0)	497 (62.1)	545 (65.7)	493 (63.0)
Checkpoint inhibitor initiation, n (%)	1,973 (48.7)	429 (52.4)	413 (50.4)	401 (50.1)	380 (45.8)	350 (44.7)

to the index date. Finally, patients were required to have continuous enrollment in their health plan in the Optum database during the 12 months before and at least 3 months after their metastatic diagnosis.

ICI INITIATION

We examined all ICIs approved for metastatic melanoma as of 2020. These drugs were ipilimumab, pembrolizumab, nivolumab, and atezolizumab. Claims of immunotherapies were identified using the Healthcare Common Procedure Coding System codes (Supplementary Table 2). The service date on the first ICI claim after metastatic cancer diagnosis was defined as the date of treatment initiation.

COUNTY-LEVEL AND PATIENT-LEVEL CHARACTERISTICS

We extracted the zip code of a patient's residence from the Optum data, which was crosswalked to county. Information on the racial composition and poverty level of each county was taken from the Census Bureau.[23] We divided all counties into 5 quintiles based on the percentage of population that are minority (non-White race), with a higher quintile indicating a higher percentage of minority population. Using information from the rural-urban continuum codes,[24] we categorized counties into metro and non-metro. We extracted density of medical oncologists in a county from a previous study.[25] Patient-level characteristics included age, sex, Charlson comorbidity index,[26] Medicare Advantage vs non-Medicare commercial insurance, and diagnosis year.

STATISTICAL ANALYSIS

We first examined the uptake of ICIs and the days from metastatic cancer diagnosis to ICIs, in aggregate and stratified by quintile of percentage of population that are minority. To account for differential follow-up time and censoring, we plotted Kaplan-Meier curves to visualize time from diagnosis to initiation, with steeper curves indicating faster initiation. To examine if disparity increased or decreased over time, we estimated ICI adoption rate in high-minority (quintile 5) vs low-minority (quintile 1) counties in each year.

Time from diagnosis to initiating ICIs was then analyzed using Cox proportional hazards models. The primary predictor of interest was the quintile of percentage of population in a county that are minority. Other covariates included age, sex, Charlson comorbidity index, insurance type, and year of diagnosis. In a secondary analysis, we stratified the composition of minority population into Black, Hispanic, and other minority, and included quintiles of these measures in the Cox model. In a sensitivity analysis, we examined whether patients used any ICIs during the study follow-up in logistic regressions. In all regressions, we clustered standard errors at the county level. A two-sided test with a P value of less than 0.05 was considered statistically significant. We used Stata 15.1 for all statistical analyses. This study was exempted from the University of Texas MD Anderson Cancer Center Institutional Review Board, as it used secondary data without patient identifying information.

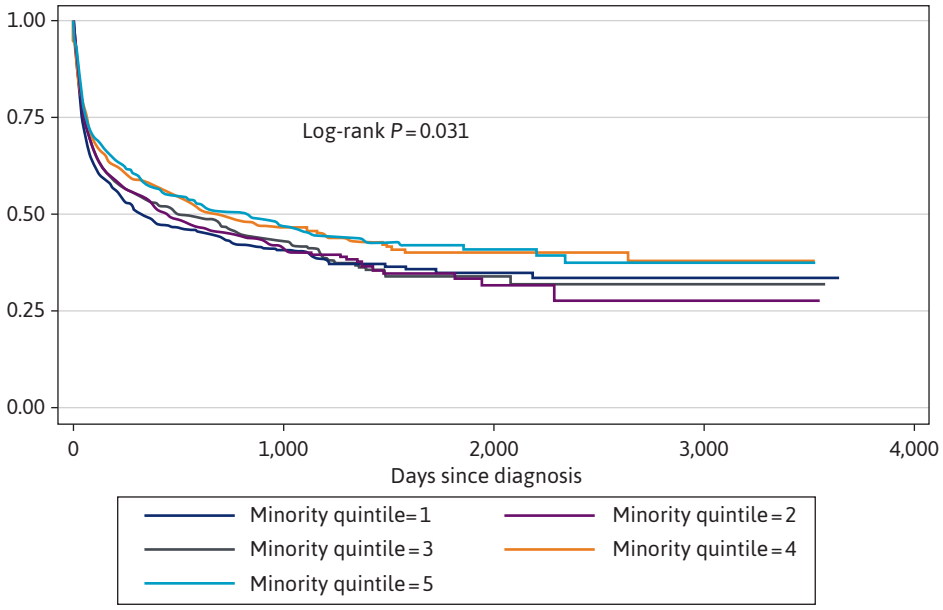
Results

Between 2011 and 2020, 4,052 patients in our data were diagnosed with metastatic melanoma and met our inclusion criteria (Table 1). The average age of our study sample was aged 68.7 years (SD = 14.0), and 36.5% were female. Approximately 42.5% of our study sample had a comorbidity

TABLE 2 Checkpoint Inhibitor Adoption Rate and Median Time From Diagnosis to Initiation by Minority Quintile

	All N = 4,052	By minority quintiles				
		1	2	3	4	5
Checkpoint inhibitor initiation, n (%)	1,973 (48.7)	429 (52.4)	413 (50.4)	401 (50.1)	380 (45.8)	350 (44.7)
Median days from diagnosis to initiation of checkpoint inhibitors, mean (SD)	548 (47.5)	321 (75.3)	449 (83.1)	503 (90.8)	696 (140.8)	830 (133.0)

FIGURE 1 Time to Immune Checkpoint Inhibitor Initiation After Metastatic Melanoma Diagnosis by County-Level Minority Quintiles

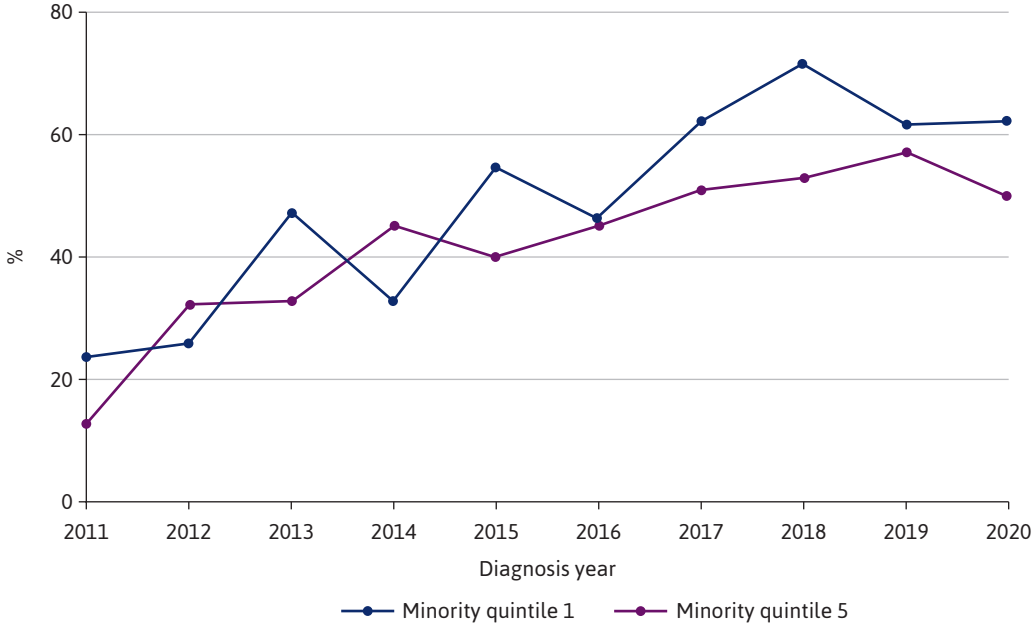


score of 0, 21.9% had a score of 1 or 2, and 33.4% had comorbidity score of 3 or higher. Approximately 63.6% of our sample had Medicare Advantage (as opposed to non-Medicare commercial insurance). Approximately 87.6% of our study population resided in metro areas. On average there were 4.7 (SD = 4.8) medical oncologists per 100 000 population in the county. Over the entire follow-up period, approximately 49% of the study population used ICIs. High-minority counties appeared to correlate with metro areas, greater percentage of population living under poverty, and higher density of medical oncologists.

The adoption of ICIs in a county declined and the delay in initiation went up as the percentage of minority in a county increased (Table 2). The percentage of eligible patients with metastatic melanoma who initiated ICIs in our study period were 52.4%, 50.4%, 50.1%, 45.8%, and 44.7% for minority quintiles 1 through 5, respectively. The median days from diagnosis to initiation of ICIs were 321, 449, 503, 696, and 830 for minority quintiles 1 through 5, respectively. Kaplan-Meier plot of ICI initiation, as well as log-rank test, also confirmed that patients who lived in counties with greater percentage of minority population had significantly slower initiation compared with those who lived in counties with lower percentage of minority (log-rank test $P = 0.031$) (Figure 1). There also appeared to be an increasing gap between high-minority (quintile 5) and low-minority (quintile 1) regions in uptake in ICIs, especially after 2016 (Figure 2).

In multivariate Cox regression analysis, greater percentage of minority population in a county was associated with slower initiation of ICIs (Table 3). Compared with counties in the lowest quintile of percentage of minority population, the adjusted hazard ratio of the second, third, fourth, and highest quintile were 0.94 (95% CI = 0.81-1.08),

FIGURE 2 Gaps Between High-Minority (Quintile 5) and Low-Minority (Quintile 1) Counties in Checkpoint Inhibitor Adoption Rate Over Time



0.88 (95% CI = 0.76-1.02), 0.81 (95% CI = 0.68-0.97), and 0.77 (95% CI = 0.66-0.91), respectively. In terms of patient-level characteristics, older age (≥75), and female were associated with significantly slower initiation. Furthermore, initiation was significantly faster in recent years compared with 2011, which is when the first ICI was approved.

In secondary analysis, when the percentage of minority population at county level was stratified into Black, Hispanic, and other minority, the slower initiation in high-minority counties was driven by counties with the highest percentage of Hispanic population (Table 3). The hazard ratio of counties in the highest quintile of Hispanic population was 0.74 (95% CI = 0.61-0.89) compared with counties in the lowest quintile of Hispanic population. Similar to the primary analysis, older age, female, Medicare Advantage, and being diagnosed in recent years were associated with significantly slower initiation.

In the sensitivity analysis, greater minority percentage in a county was associated with lower odds of using ICIs (Supplementary Table 3). Compared with the lowest quintile of minority population, the adjusted odds ratio of the second, third, fourth, and highest quintile was 0.93 (95% CI = 0.75-1.14), 0.89 (95% CI = 0.71-1.11), 0.78 (95% CI = 0.61-1.00), and 0.73 (95% CI = 0.58-0.93), respectively. Similar to findings from the Cox model, the lower odds of ICI use in high-minority counties were driven by the lower use in counties with the greatest percentage of Hispanic population (Supplementary Table 4). The odds ratio of counties in the highest quintile of Hispanic population was 0.68 (95% CI = 0.53-0.89) compared with counties in the lowest quintile of Hispanic population.

Discussion

Our retrospective cohort study of 4,052 commercially insured patients with metastatic melanoma revealed decreased and delayed initiation of ICIs for metastatic melanoma in US counties with increased percentage of racial and ethnic minorities. We have found that these disparities were primarily driven by counties with the highest percentage of Hispanic population. Other factors associated with delayed initiation of ICIs included older age, female sex, and diagnosis in earlier years.

ICIs are rapidly becoming a mainstay of cancer treatment. One study showed that the percentage of US patients with cancer who are potentially eligible for ICIs increased from 1.5% in 2011 to more than 40% in 2018, though only about 13% of patients will respond to these treatments.[27,28] There is evidence that Hispanic patients with melanoma present at later stages, are younger, and are more likely to have aggressive disease, making them more likely to be

TABLE 3 Cox Proportional Hazards Regression Output With Minority Population Quintiles

	Model 1[a]		Model 2[b]	
	Hazard ratio (95% CI)	*P* value	Hazard ratio (95% CI)	*P* value
Percentage of minority in a county quintile (ref: quintile 1)				
2	0.94 (0.81-1.08)	0.389	—	—
3	0.88 (0.76-1.02)	0.090	—	—
4	0.81 (0.68-0.97)	0.025	—	—
5	0.77 (0.66-0.91)	0.002	—	—
Percentage of Black race in a county quintile (ref: quintile 1)				
2	—	—	0.96 (0.82-1.13)	0.634
3	—	—	0.96 (0.82-1.12)	0.606
4	—	—	1.01 (0.87-1.18)	0.857
5	—	—	1.00 (0.88-1.15)	0.961
Percentage of Hispanic race in a county quintile (ref: quintile 1)				
2	—	—	1.09 (0.94-1.26)	0.628
3	—	—	0.88 (0.75-1.03)	0.054
4	—	—	0.87 (0.74-1.04)	0.253
5	—	—	0.74 (0.61-0.89)	<0.001
Percentage of other minority in a county quintile (ref: quintile 1)				
2	—	—	1.05 (0.91-1.21)	0.507
3	—	—	1.00 (0.86-1.17)	0.966
4	—	—	0.96 (0.82-1.14)	0.671
5	—	—	0.94 (0.81-1.10)	0.455
Age group (ref: <55)				
55 - <65	0.93 (0.80-1.08)	0.342	0.93 (0.80-1.09)	0.385
65 - <75	0.81 (0.66-1.00)	0.056	0.82 (0.66-1.02)	0.069
≥75	0.59 (0.47-0.75)	<0.001	0.61 (0.48-0.77)	<0.001
Female	0.83 (0.75-0.91)	<0.001	0.83 (0.75-0.91)	<0.001
Charlson comorbidities (ref: 0)				
1-2	1.00 (0.90-1.12)	0.962	0.99 (0.89-1.10)	0.862
≥3	0.91 (0.81-1.02)	0.115	0.90 (0.80-1.01)	0.084
Medicare Advantage	0.86 (0.73-1.02)	0.092	0.87 (0.74-1.03)	0.113
Diagnosis year (ref: 2011)				
2012	1.69 (1.25-2.28)	0.001	1.69 (1.25-2.28)	0.001
2013	1.82 (1.35-2.44)	<0.001	1.81 (1.35-2.43)	<0.001
2014	2.28 (1.74-2.98)	<0.001	2.26 (1.73-2.95)	<0.001
2015	2.81 (2.18-3.62)	<0.001	2.80 (2.17-3.60)	<0.001
2016	3.15 (2.45-4.05)	<0.001	3.18 (2.47-4.08)	<0.001
2017	3.72 (2.83-4.87)	<0.001	3.71 (2.83-4.86)	<0.001
2018	4.84 (3.78-6.20)	<0.001	4.84 (3.78-6.19)	<0.001
2019	5.20 (4.06-6.67)	<0.001	5.21 (4.07-6.68)	<0.001
2020	6.51 (5.06-8.37)	<0.001	6.53 (5.09-8.39)	<0.001

[a]*Model 1 adjusted for quintiles of percentage of a county's population from racial and ethnic minorities.*

[b]*Model 2 adjusted for quintiles of percentages of a county's population from Black, Hispanic, and other racial and ethnic groups, respectively.*

Ref = reference.

candidates for ICIs.[11] Therefore, our results are of particular importance, as effective, targeted medication use strategies may improve early initiation of ICIs in these patients, which could have a significant, positive impact on survival and clinical outcomes. Importantly, we have found that the gap in ICI initiation amplified from low-minority counties to high-minority counties, which signifies the increasing need for effective interventions that can improve medication use in patients who live in high-minority regions.

There are likely several factors that contribute to the observed neighborhood disparities in the initiation of ICIs. Neighborhoods are important contexts in which health is shaped. High-minority neighborhoods are more likely to be marginalized and disadvantaged with less investment, worse infrastructure, and fewer economic opportunities.[29,30] Poor physical environment, such as high air pollution index and lack of green spaces, has also been associated with increased incidence of many diseases, including cancer.[31,32] Although such neighborhoods might attract fewer physicians and less local health promotion expenditure, it is also possible that these factors impact use, even if high-quality care is available. For example, patients without reliable public transportation are less likely to attend scheduled appointments.[30]

The delay in ICI initiation might also be influenced by demand-side factors. Minorities are more likely to be uninsured or underinsured.[29] Although all patients in our study were required to have commercial health insurance or Medicare Advantage, it is possible that financial concerns remained a major influence on treatment seeking behaviors, especially for those enrolled in health care plans with significant out-of-pocket expenses, such as high-deductible plans. Limited English proficiency (LEP) is another major barrier to care that disproportionately affects minorities and immigrants.[33,34] Despite widespread implementation of medical interpretation services, there is evidence that health care providers with limited medical Spanish proficiency underuse interpreters, particularly

when wait times are required.[35,36] This has been shown to be detrimental to patient-physician communication and patient outcomes.[36] A 20-year nationally representative survey of US medical expenditure revealed that Hispanic adults with LEP received one-third less medical care compared with those proficient in English.[34] This disparity is particularly striking considering that 25 million Americans have LEP and more than 41 million speak Spanish at home.[34,37] Therefore, it is perhaps not surprising that the greatest delay in ICI initiation in our study was observed in predominantly Hispanic neighborhoods.

Interestingly, we found that patients in high-minority neighborhoods experienced delayed ICI treatment despite higher density of medical oncologists compared with low-minority neighborhoods. This implies that increasing the density of medical oncologists alone may not improve patient care in disadvantaged neighborhoods. We need to understand characteristics of physicians and practices who treat primarily minority patients and the reasons why these patients do not receive optimal care. There are several possible explanations. One study found that discordant patient-physician interactions (eg, between a White physician and a non-White patient) result in poorer communication and are more likely to produce mistrust.[38,39] Providers with high levels of implicit racial bias were found to be more likely to conduct shorter visits and were perceived as less supportive by their minority patients.[39] Another study showed that oncology visits with Black patients included fewer mentions of clinical trials and less discussion of available treatment options compared with those with White patients, which could be contributing to decreased cancer clinical trial participation of racial minorities.[40] This is consistent with prior evidence showing that the disparities in ICI use persist in both routine care and clinical trial settings.[41] Only 5% of US oncologists self-identify as Black/African American or Hispanic/Latino, which is the lowest out of all internal medicine subspecialties.[42] Therefore, it is possible that racial and ethnic bias is a stronger determinant of treatment and outcomes than the geographic proximity of medical oncologists. Furthermore, the presence of a higher density of medical oncologists in high-minority areas does not guarantee that these patients are able to access care, as other barriers exist. Systemic changes that counteract racial bias in treatment algorithms and enable individuals from more diverse backgrounds to pursue a career in oncology could have far-reaching positive effects on the health of minority patients.[43] Additionally, more immediate interventions, such as provider cultural competency training, could further improve patient outcomes and increase clinical trial participation among minorities.[44,45]

It has been suggested that the targeting of skin cancer and photoprotection education campaigns toward White adults can be an important factor in the disparate outcomes among patients of color.[46,47] A cross-sectional survey from the National Cancer Institute showed that Black patients perceived their risk of skin cancer as low and were significantly less likely perform self-examinations.[48] Both Black and Hispanic patients were found to be more likely to believe that skin cancer is preceded by pain or other symptoms, that it cannot be prevented, and that sunscreen benefits only those with lighter skin tones.[48,49] Another recent survey found significantly decreased overall melanoma awareness among racial and ethnic minorities.[50] However, there is also evidence that educational interventions can be impactful and effective. One study found that people of color might benefit from specific physician recommendations, such as to perform self-examinations focused on the palms and soles, which are more commonly involved in patients with darker skin tones.[51] Therefore, more targeted educational efforts and increased representation of darker skin in melanoma awareness campaigns might help dispel the myth that only White patients are affected. Linguistically and culturally targeted efforts might also be beneficial.[52,53] However, information about neighborhood-specific awareness campaigns is lacking. Based on our findings, such efforts could be of particular benefit when combined with targeted educational materials in neighborhoods with higher proportion of minorities.

LIMITATIONS

Our study has limitations. Because of the nature of our database, we only included patients with commercial health insurance or Medicare Advantage, which could affect the generalizability of our results. Race was not available in our version of Optum data that included zip code, preventing us from adjusting for individual patient race. However, Optum claims database pools data from multiple sources and includes a large proportion of US adults by including working-age adults, their dependents, and older adults with Medicare Advantage. Although patients without health insurance and with low income are known to have delayed initiation of ICIs for melanoma,[41,54] all patients included in the present study were required to have commercial insurance because of the nature of our database. Our study is also limited by the inherent characteristics of claims data, which rely on the accuracy of diagnostic codes and are not comprehensive of all patient characteristics. To address this, we have extensively adjusted our analysis for possible known confounders. We have used the Charlson comorbidity score, which has been shown to accurately predict mortality in population-level data.[26] However, individual patient's characteristics,

such as disease severity, household income, and religious belief, may influence how fast they start their cancer treatment, although such information was not available in our data. Lastly, we have not been able to account for factors such as patient preference and family financial standing, which can drive treatment choices.

Conclusions

We have found that patients with metastatic melanoma living in counties with higher proportion of minorities, particularly of Hispanic origin, are more likely to experience delays in ICI treatment. Our study adds valuable information that could be used to guide the development of medication use strategies such as targeted physician interventions, patient mailings, and patient advocacy, as well as further emphasizing the significant health care inequalities present in the United States. Increased awareness of the factors driving use or delayed initiation of ICI treatment can help overcome sociodemographic disparities in melanoma outcomes.

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