Descriptive Analysis of Health Disparities Between Black and White People With Multiple Sclerosis in the Deep South

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CE INFORMATION

ACTIVITY AVAILABLE ONLINE: To access the article and evaluation online, go to https://www.highmarksce.com/mscare.

TARGET AUDIENCE: The target audience for this activity is physicians, advanced practice clinicians, nursing professionals, social workers, and other health care providers involved in the management of patients with multiple sclerosis (MS).

LEARNING OBJECTIVES:

1. Recognize that Black people with MS may have barriers to care that potentially contribute to a more aggressive disease course in order to better address potential barriers to care.
2. Construct patient-centered, team-focused diagnostic and management plans for Black people with suspected or diagnosed MS in order to provide clinical support that may improve outcomes.

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ABSTRACT

BACKGROUND: Black people with multiple sclerosis (MS) have a worse disease course and higher rates of progression than White people with MS. Contributing factors to health disparities are understudied.

METHODS: Data were collected retrospectively from the electronic medical records of 500 people with MS treated between 2013 and 2022 at a university comprehensive MS center in a southern state. Multiple logistic regression analyses were used to determine the associations between 2 disability outcomes (ie, low vs high Expanded Disability Status Score [EDSS] and ambulatory assistance [AMB] requirements) and age, sex, body mass index (BMI), MS type, disease duration, hypertension status, diabetes status, smoking status, adjusted gross income, and health insurance type for Black people with MS and White people with MS.

RESULTS: Of the cohort, 39.2% identified as Black people with MS and the rest were White people with MS. Approximately 80% of White people with MS had relapsing MS (RMS) vs almost 90% of Black people with MS. Black people with MS were more likely to have a higher EDSS (OR 5.0, CI 3.0-8.4) and AMB (OR, 2.8; 95% CI, 1.6-4.8) than White people with MS. Among White people with MS, women (OR, 0.5; 95% CI, 0.3-0.9) and people with RMS (OR, 0.13; 95% CI 0.06-0.3) were less likely to have higher EDSS scores. Among Black people with MS, neither female sex nor RMS status was associated with a lower risk of having a higher EDSS (OR, 0.685; $P = .43$ and OR, 0.394; $P = .29$, respectively).

CONCLUSIONS: The disparity in disability outcomes between Black people with MS and White people with MS may be driven by more disabling courses for Black people with RMS and by female sex, though further study is needed to determine causes for this outcome.

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Multiple sclerosis (MS) is an immune-mediated disease of the central nervous system with inflammatory and neurodegenerative components. It is a leading cause of neurological disability in young adults.[1] A prevalence study published in 2019 estimated that there are more than 700,000 people aged 18 or older with MS in the United States, and the rate continues to rise.[2] Historically, White Americans were thought to have higher MS prevalence. However, more recent incidence studies in non-White populations have shown higher and increasing incidence among Black Americans. Studies with higher minoritized incidence of MS showed that Black Americans have up to a 47% higher risk of developing MS than White Americans.[3,4] Also, disease presentations and outcomes are different among racial groups with many studies reporting that Black Americans have a more aggressive disease course with earlier progression and earlier and higher rates of disability.[5-7] When evaluating the MS mortality rate between 1999 and 2015, Amezcua et al found that Black men with MS had the highest rate of early mortality at the average age of 54 when compared to White or Hispanic people with MS.[8]

To understand the heterogeneity of the disease in Black Americans, various studies investigated genetic predisposition[9,10] as well as social, economic, and environmental factors that could contribute to variation in the clinical presentation of the disease.[11] Despite extensive study, a clear explanation of these disparities has not yet been established and further comprehensive research is needed to better understand and remedy disparate outcomes. The objective of this study was to examine the disparities in disability outcomes between White people with MS and Black people with MS who were treated and followed by the University of Alabama at Birmingham (UAB) Comprehensive Multiple Sclerosis Center. Additionally, utilizing a retrospective data set, we also sought to understand the factors that were associated with disparities by looking into the effects of various clinical and socioeconomic characteristics.

METHODS

The UAB Comprehensive Multiple Sclerosis Center sees more than 3000 individuals with MS annually. Just under 40% of these patients self-identify as Black or African American. After obtaining institutional review board approval (UAB #300006395), we developed a database of 500 patients via a retrospective chart review, collecting data from the electronic health records (EHRs) of 500 randomly selected patients with MS treated between 2013 and 2022 at UAB. Multiple sclerosis diagnosis was identified by *International Statistical Classification of Diseases, Tenth Revision* (G35) code and verified during the chart review process.

This study included only patients who self-identified as White or Black or African American at one of their clinic visits and had this identifier included in their chart. Only 1% of our patient population does not identify as 1 of these 2 racial groups. Based on a literature review and clinical expert opinion, we collected variables including basic demographic data, disease duration, disability scale scores, date of disease onset, and type of MS. Comorbid conditions were obtained from the EHRs and included hypertension (HTN), diabetes mellitus (DM), smoking status, and body mass index (BMI), with BMI equal to or greater than 30 indicating obesity. Disability scales included the Expanded Disability Status Scale (EDSS), which was retrospectively calculated from the physical exam documented in the medical charts. EDSS was coded with a value of 1 for an EDSS score less than 4, 2 for a score between 4 and 5.5 inclusive, and 3 for a score of 6 or greater. EDSS scores were calculated from the patients' initial visits and most recent clinic visits. We also captured ambulatory status with 0 indicating no assistance required, 1 indicating unilateral assistance required, 2 indicating bilateral support required, and 3 indicating wheelchair use.

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We assessed the social determinants of health (SDOH) by looking at the insurance type and the zip code adjusted gross income (AGI). The AGI was determined using the zip codes from patients' charts at the time of data capture and calculated from the 2019 Internal Revenue Service data (publicly available at irs.gov /statistics/soi-tax-stats-individual-income-tax-statistics-zip-code -data-soi). This was coded as 1 for an AGI less than $25,000, 2 for an AGI between $25,000 and $50,000, 3 for an AGI between $50,000 and $75,000, and > 3 for an AGI more than $75,000. We performed statistical analysis utilizing SPSS (29.0.0.0). Descriptive analyses were conducted by using a χ^2 test for categorical variables (eg, sex, MS type) and independent samples *t* test for continuous variables (eg, age, number of relapses). Multiple logistic regression analyses were used to determine the associations between EDSS and odds of requiring ambulatory assistance with race and by controlling for age at disease onset, age at time of capture, sex, comorbidities, MS phenotype, AGI, and insurance status. Statistical (eg, χ^2 test) and logical measures were used to avoid multicollinearity.

We then studied the association of higher disability (EDSS score and ambulatory status) to relapsing MS (RMS) and progressive MS (PMS) phenotypes, controlling for age, sex, race, AGI, insurance status, and comorbidities.

TABLE 1. Factors Associated With EDSS Score Greater Than 4 for People With RMS (N = 420)

Variables	OR	95% CI	*P* value
Time of capture age	1.03	1.02-1.06	.001
Female	0.52	0.30-0.90	.020
Race			
Black (White = ref)	4.82	2.85-8.16	<.001
Comorbidity			
HTN (no = ref)	0.59	0.32-1.09	.093
HTN + DM (no = ref)	2.84	1.22-6.65	.016
HTN + Smoking (no = ref)	1.16	0.54-2.52	.706
Time of capture BMI	1.00	0.98-1.04	.576
Adjusted gross income per zip code (4 = ref)			
AGI = 2	2.08	1.14-3.80	.017
AGI = 3	1.32	0.70-2.49	.388
Insurance type (> 1 type = ref)			
Private	0.22	0.10-0.45	<.001
Medicaid and/or Medicare	0.99	0.46-2.11	.971
Self-paid	0.79	0.20-3.20	.743

AGI, adjusted gross income (coded as 1<$25,000, 2 = $25,000-$50,000, 3 = $50,000-$75,000, and >3≥$75,000 per year); BMI, body mass index; DM, diabetes mellitus; EDSS, Expanded Disability Status Scale; HTN, hypertension; N, number; ref, reference group; RMS, relapsing multiple sclerosis.

RESULTS

Out of the 500 patients in this study, 60.8% identified as White, and 39.2% identified as Black. **TABLE S1** contains a summary of the clinical and socioeconomic characteristics of each group. At the time of the study, there was no significant difference in the average age at data acquisition between the 2 populations; the average for White people with MS was 47 years old and the average for Black people with MS was 49 years old (*P*=.081). Black people with MS were younger at disease onset than White people with MS, with the first symptom for Black people with MS occurring at 32 years of age vs 36 years of age in the White people with MS group (*P*<.001). The average age of diagnosis was 33 years old for Black people with MS and 38 years old for White people with MS (*P*<.001). Whereas 90% of Black people with MS had relapsing MS (RMS), only 80% of White people with MS had a relapsing form of MS (*P*=.001). The average duration of disease for these patients with RMS was 9.8 years for Black people with MS and 12.5 years for White people with MS. The average duration of follow-up from diagnosis to most recent clinic appointment was 116 months for Black people with MS and 149 months for White people with MS. There was not a statistically significant difference in time from symptom onset to diagnosis between Black people with MS and White people with MS, with both averaging close to 2 years. The time to initiate disease-modifying therapy calculated from both symptom onset and time of diagnosis was no different among the groups (Table S1).

At disease onset, almost 70% of Black people with MS were hospitalized in contrast to 30% of White people with MS (*P*<.001). More Black people with MS than White people with MS were diagnosed with transverse myelitis (TM) as their first disease event, 41.8% vs 31.6%, respectively (*P* ≤ .001). Similarly, vision loss at diagnosis was more commonly seen among Black people with MS than White people with MS, 38.3% vs 28.6%, respectively (*P*=.024). Our cohort showed that more Black people with MS had Medicaid insurance than White people with MS (*P*<.001; Table S1). Black people with MS had a higher burden of disease severity in virtually all measures even after controlling for sex, age at diagnosis, disease duration, MS type, BMI, HTN, DM, and socioeconomic factors such as zip code, AGI, and insurance status. At both their initial and most recent clinic visits, Black people with MS were more likely to have a higher EDSS score (OR, 5.0; 95% CI, 3.0-8.4; *P*<.001) and were more likely to require ambulatory assistance than White people with MS (OR, 2.8; 95% CI, 1.6-4.8; *P*<.001). Black people with MS had a greater chance of having a higher initial EDSS (OR, 2.026; *P*=.006) and most recently documented EDSS (OR, 4.053; *P*<.0001). Results of the logistic regression analysis for the EDSS are summarized in **TABLE 1**.

When we looked at the effect of HTN, DM, and smoking on MS disability individually, the results were not statistically significantly different when we compared races or when we analyzed the total cohort. However, the entire cohort did have higher rates of disability for RMS patients with both HTN and DM when compared with patients with either HTN or DM, or patients with neither (OR, 2.84; 95% CI, 1.2-6.6; *P* = .016). This did not show differing effects when we compared Black people with MS to White people with MS and only held true at the combined cohort level.

When examining impact of insurance type, patients with private insurance were less likely to require assistance with ambulation than patients with publicly funded insurances or uninsured patients (Medicaid, Medicare, self-pay) (OR, 0.29; 95% CI, 0.12-0.69; *P* = .005). That was true for EDSS as well (OR, 0.37; 95% CI, 0.172-0.83; *P* = .015).

Among White people with MS, female patients and patients with RMS were less likely to have higher EDSS when compared

PRACTICE POINTS

Clinicians should consider more aggressive treatment of Black people with multiple sclerosis earlier on in their disease course.

Comorbidities, geographic location, and socioeconomic status should be considered when pursuing treatment of people with multiple sclerosis. ■

to male patients and patients with progressive disease, respectively (females: OR, 0.5; 95% CI, 0.3-0.9; RMS: OR, 0.13; 95% CI, 0.06-0.3). Surprisingly, this disability reduction with sex or MS type was *not* found among Black people with MS. Neither female sex nor RMS status was associated with a statistically significant lower risk of having a higher EDSS for Black people with MS (female: OR, 0.7; P=.43; RMS: OR, 0.394; P=.29) (**TABLE 2**). This observation even held true after controlling for age, sex, comorbidities, insurance status, and zip code–based AGI. Black persons with RMS have higher EDSS scores (OR, 4.82; 95% CI, 2.85-8.16; P<.001) and are more likely to require ambulatory assistance (OR, 2.64; 95% CI, 1.5-4.8; P<.001). For the entire cohort, patients living in the lowest AGI group for which we had sufficient data had higher EDSS scores (OR, 2.083; P=.017).

DISCUSSION

Our data demonstrate that Black persons with MS, as compared with White persons with MS, have worse disability outcomes, more frequent need for ambulatory assistance, and higher initial EDSS. This was true even after controlling for the age of disease onset, age at diagnosis, sex, comorbidities, and socioeconomic status (SES). Interestingly, White women with RMS had much better outcomes than Black women with RMS. We did not see a higher prevalence of PMS in Black people with MS as was seen in previous studies,[7,12] and progression did not drive disability in our cohort. This relatively unique finding suggests a more aggressive course in relapsing MS may be a large driver in the disparity in outcomes between Black and White persons with MS.

From early in the disease course, Black people with MS have worse cognitive and fine motor performance.[13,14] Paraclinical measures also showed differences in the outcomes with faster rates of MRI lesion accumulation, gray matter atrophy, decreased brain volume, and retinal layer atrophy in Black people with MS.[15,16] In our cohort, Black people with MS presented with more severe disease and 70% required hospitalization at disease onset, most of them with severe motor and visual relapses. We found that age at disease onset was younger in Black people with MS, which was consistent with reported findings from other cohorts with Black people with MS being diagnosed younger than White people with MS.[4,6]

In our geographical area, access to MS care is limited and this can sometimes lead to delays in diagnosis and treatment. We did not find differences in the time to diagnosis or initiation of disease-modifying therapy between Black people with MS and White people with MS, similar to other reports[5,6] showing a shorter delay between symptom onset and diagnosis in Black people with MS, although one study[17] reported the opposite, finding a diagnostic delay for people of color, in their terminology. However, a confounder we could not adequately adjust for in this calculation was the increased likelihood of hospital admission at first event for Black people with MS, which likely skews the data to earlier diagnosis for many patients. It is possible that a much earlier diagnosis due to hospitalization is compensating for a delay in diagnosis in Black people with MS who have a milder disease onset. Similarly, no difference was found in the time from symptom onset or diagnosis to the start of disease-modifying treatment between White patients with MS and Black patients with MS in our clinic, consistent with prior reports.[6]

As is well established across the literature, being an underrepresented person in the United States is strongly linked to health disparities due to multiple socioeconomic factors including poverty, education level, health literacy, and access to care,[8,18] and we must work to reduce these disparities. Neighborhoods with the highest socioeconomic disadvantage are associated with a higher risk of disability progression and various comorbidities,[19,20] mental health disorders, and health-seeking behavior.[21] The reasons for this association are multifactorial. Abbatemarco et al[22] looked at socioeconomic inequalities and disease severity and quality of life via outcomes on the Multiple Sclerosis Performance Test (MSPT) and the Quality of Life in Neurological Disorders tool. People from the neighborhoods with the highest disadvantages did worse on both measures.[22] In the MS PATHS study (NCT02996084), patients living in the most socioeconomically disadvantaged areas had a worse baseline and higher rates of worsening in measured neurologic performance and patient-reported outcomes.[15] The MS PATHS study showed that among White people with MS, neighborhood disadvantages were associated with slower processing speed testing and walking speed testing scores; however, Black people with MS in this cohort did not demonstrate this finding and had no difference in MSPT based on the area deprivation index, which may indicate that disparities are driven by multiple phenomena and not limited to socioeconomic factors.

Similarly, Orlando et al studied the association of race with higher EDSS scores and found that the difference was not significant when accounting for SDOH, showing instead that patients with high levels of neighborhood disadvantages have worse MS disability when identified via racial groups.[23] In a study done by Pimentel Maldonado et al, Black people with MS were more likely to have lower socioeconomic status, yet race, specifically, did not significantly impact mental health comorbidities.[21] In our cohort, patients with private insurance were less likely to have an increase in disability and had lower EDSS scores than patients with Medicare, Medicaid, or those with no insurance. This effect did not differ between Black people with MS and White people

TABLE 2. Factors Associated With EDSS Greater Than 4

Variables	Black people with RMS (n = 176)			White people with RMS (n = 244)		
	OR	95% CI	*P* value	OR	95% CI	*P* value
Time of capture age	1.04	1.00-1.08	0.027	1.04	1.00-1.07	.026
Female	0.70	0.29-1.73	0.444	0.42	0.21-0.86	.017
Comorbidity						
HTN (no = ref)	0.53	0.22-1.27	0.153	0.63	0.25-1.60	.335
HTN + DM (no = ref)	3.64	0.96-13.83	0.058	2.05	0.65-6.49	.220
HTN + smoking (no = ref)	1.97	0.46-8.42	0.360	0.90	0.33-2.45	.841
Time of capture BMI	0.99	0.95-1.03	0.567	1.03	0.99-1.08	.100
Adjusted gross income per zip code (4 = ref)						
AGI = 2	3.19	1.21-8.40	0.019	1.30	0.57-2.96	.532
AGI = 3	1.86	0.61-5.62	0.273	1.02	0.46-2.24	.971
Insurance type (> 1 type = ref)						
Private	0.17	0.04-0.65	0.010	0.21	0.08-0.55	.001
Medicaid and/or Medicare	0.85	0.19-3.77	0.833	0.92	0.35-2.38	.859
Self-pay	0.38	0.05-2.81	0.343	2.27	0.30-16.87	.425

AGI, adjusted gross income (coded as 1 < $25,000, 2 = $25,000-$50,000, 3 = $50,000-$75,000, and > 3 ≥ $75,000 per year); BMI, body mass index; DM, diabetes mellitus; EDSS, Expanded Disability Status Scale; HTN, hypertension; N, number; ref, reference group; RMS, relapsing multiple sclerosis.

with MS. It is worth noting that low AGI and lack of insurance could be the result of MS-related disability and a loss of employment.[24] Other factors for SES that can be less biased are factors that started before MS, such as education level,[25,26] but we did not have this factor in our data and were unable to utilize it for corrections. More complete and sophisticated adjustments when comparing disparate outcomes in MS are needed and will only be captured through prospective study.

One explanation for disparate outcomes may be comorbid illness. Black people with MS are disproportionately more affected by vascular comorbidities including hypertension, type 2 DM, hyperlipidemia, and obesity.[27,28] Co-occurrence of vascular comorbidities in MS is common and associated with worse outcomes, including increased mortality, brain atrophy, and need for ambulatory assistance. This is an effect that proportionally increases with an increase in number of comorbidities.[29-32] If these disparities in cardiometabolic disease also occur at higher rates in Black people with MS, it may explain some of the worsened disability outcomes in this population.[33] Additionally, some of the disparity could be explained by the fact that obesity is reported as a risk factor for MS and disease activity.[34] In our study, at diagnosis, Black people with MS had a higher BMI than their White counterparts (32.6 vs 29.6; $P \leq .001$).

There was no significant effect when we analyzed whether DM, HTN, HLD, and smoking are distinctly correlated with health disparities between Black people with MS and White people with MS in our cohort. We did find that DM was more common among Black people with MS with high EDSS scores ($P = .06$). We examined the effects of multiple comorbidities, and the only significant one was that individuals with RMS and *both* DM and HTN had higher EDSS scores, a finding that was not unique to either racial group independently but only applied to the entire cohort. Future research may find that these comorbidities have a larger influence on outcomes than our retrospective database could capture. Admittedly, it is possible that we did not accurately capture the status of these comorbidities; our data did not have information about disease management and how that influences patients' MS disease outcome. A study conducted at our UAB medical center in 2021 examined the difference in cardiovascular comorbidities between Black people with MS and White people with MS; it showed that Black people with MS were more than twice as likely to be diagnosed with DM (OR, 2.15; 95% CI, 1.70-2.72; $P < .0001$) compared with White people with MS. Sex did not present a greater likelihood of being diagnosed with DM; however, men were 1.22 times more likely to have HTN than women (95% CI, 1.01-1.49; $P = .0439$). Increased age and higher BMI were also significantly associated with the likelihood of a diagnosis of DM and HTN (OR, 1.05; 95% CI, 1.04-1.06; $P < .0001$).[35]

Our study has several limitations. The most significant and pervasive limitation is the nature of EHR review and retrospective data acquisition. This allowed various forms of bias to enter our data and may have resulted in incomplete capture of information. The patients did not have a standard follow-up duration, and the difference in average disease duration between Black people with MS and White people with MS was statistically significant. Race and ethnicity definitions were self-reported during clinical contact, recorded in the patients' EHR, and pulled from the chart without verification. Data were pulled from the EHR over a 10-year period and some information recorded in 2013 may not be comparable to data pulled from more recent visits. Socioeconomic controls of insurance status and zip code–based AGI incompletely capture all known SDOH and we could not fully control for the impact of SDOH due to inadequate data availability. Additionally, zip code was pulled from the EHR at the time of data review, which may not reflect patients' place of residence at diagnosis. A prospective study would allow for standardized and validated capture of socioeconomic factors, such as household income, education level, health literacy, social support measures, and other factors that are not well captured in the EHR. In addition, further exploration of the physical impact of MS and a more detailed assessment of disability could be captured in real time as well. For example, understanding how much walking limitation

vs visual limitation vs fatigue affects individuals would allow us to better understand how the disease may impact individuals differently. And, as mentioned previously, comorbid conditions may be a driver of disparities; closer monitoring of these conditions would allow researchers to fully understand their impact on outcome disparities.

CONCLUSIONS

In our cohort, Black people with MS have higher rates of disability and a more aggressive disease course than White people with MS. Even after we adjusted for SES measures available in our retrospective study, this held true in our population. Based upon our analysis, we believe that the primary driver of this disparity lies in the outcomes of women with relapsing MS. Our cohort of Black women with RMS are at a significantly higher risk of disability than White women with RMS. To our knowledge, this is a fairly unique finding and warrants further detailed exploration.

Prior studies suggest that both Black people and Hispanic people with MS are at higher risk for early disability and worse prognosis than their White counterparts. Our cohort was no different in this regard.[5-7] We postulate that some of this difference may be attributed to the effects of systemic racism,[15,35] which may lead to the significantly disparate course for Black and White people with MS. To better understand this difference, we need serious, prospective studies across multiple large MS centers across the US. ■

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REFERENCES

1. Reich DS, Lucchinetti CF, Calabresi PA. Multiple sclerosis. *N Engl J Med*. 2018;378(2):169-180. doi:10.1056/NEJMra1401483
2. Wallin MT, Culpepper WJ, Campbell JD, et al. The prevalence of MS in the United States: a population-based estimate using health claims data. *Neurology*. 2019;92(10):e1029-e1040. doi:10.1212/WNL.0000000000007035
3. Hittle M, Culpepper WJ, Langer-Gould A, et al. Population-based estimates for the prevalence of multiple sclerosis in the United States by race, ethnicity, age, sex, and geographic region. *JAMA Neurol*. 2023;80(7):693-701. doi:10.1001/jamaneurol.2023.1135
4. Langer-Gould A, Brara SM, Beaber BE, Zhang JL. Incidence of multiple sclerosis in multiple racial and ethnic groups. *Neurology*. 2013;80(19):1734-1739. doi:10.1212/WNL.0b013e3182918cc2
5. Cree BA, Khan O, Bourdette D, et al. Clinical characteristics of African Americans vs Caucasian Americans with multiple sclerosis. *Neurology*. 2004;63(11):2039-2045. doi:10.1212/01.wnl.0000145762.60562.5d
6. Marrie RA, Cutter G, Tyry T, Vollmer T, Campagnolo D. Does multiple sclerosis-associated disability differ between races? *Neurology*. 2006;66(8):1235-1240. doi:10.1212/01.wnl.0000208505.81912.82
7. Naismith RT, Trinkaus K, Cross AH. Phenotype and prognosis in African-Americans with multiple sclerosis: a retrospective chart review. *Mult Scler*. 2006;12(6):775-781. doi:10.1177/1352458506070923
8. Amezcua L, Rivas E, Joseph S, Zhang J, Liu L. Multiple sclerosis mortality by race/ethnicity, age, sex, and time period in the United States, 1999-2015. *Neuroepidemiology*. 2018;50(1-2):35-40. doi:10.1159/000484213
9. Beecham AH, Amezcua L, Chinea A, et al. The genetic diversity of multiple sclerosis risk among Hispanic and African American populations living in the United States. *Mult Scler*. 2020;26(11):1329-1339. doi:10.1177/1352458519863764
10. Goodin DS, Oksenberg JR, Douillard V, Gourraud PA, Vince N. Genetic susceptibility to multiple sclerosis in African Americans. *PLoS One*. 2021;16(8):e0254945. doi:10.1371/journal.pone.0254945
11. Amezcua L, Rivera VM, Vazquez TC, Baezconde-Garbanati L, Langer-Gould A. Health disparities, inequities, and social determinants of health in multiple sclerosis and related disorders in the US: a review. *JAMA Neurol*. 2021;78(12):1515-1524. doi:10.1001/jamaneurol.2021.3416
12. Romanelli RJ, Huang Q, Lacy J, Hashemi L, Wong A, Smith A. Multiple sclerosis in a multi-ethnic population from Northern California: a retrospective analysis, 2010-2016. *BMC Neurol*. 2020;20(1):163. doi:10.1186/s12883-020-01749-6
13. Petracca M, Palladino R, Droby A, et al. Disability outcomes in early-stage African American and White people with multiple sclerosis. *Mult Scler Relat Disord*. 2023;69:104413. doi:10.1016/j.msard.2022.104413
14. Amezcua L, Smith JB, Gonzales EG, Haraszti S, Langer-Gould A. Race, ethnicity, and cognition in persons newly diagnosed with multiple sclerosis. *Neurology*. 2020;94(14):e1548-e1556. doi:10.1212/WNL.0000000000009210
15. Gray-Roncal K, Fitzgerald KC, Ryerson LZ, et al. Association of disease severity and socioeconomic status in Black and White Americans with multiple sclerosis. *Neurology*. 2021;97(9):e881-e889. doi:10.1212/WNL.0000000000012362
16. Caldito NG, Saidha S, Sotirchos ES, et al. Brain and retinal atrophy in African-Americans versus Caucasian-Americans with multiple sclerosis: a longitudinal study. *Brain*. 2018;141(11):3115-3129. doi:10.1093/brain/awy245
17. Mateen FJ, Trápaga Hacker C. Perceptions of people with multiple sclerosis on social determinants of health: mixed methods. *Mult Scler Relat Disord*. 2023;80:105089. doi:10.1016/j.msard.2023.105089
18. Shabas D, Heffner M. Multiple sclerosis management for low-income minorities. *Mult Scler*. 2005;11(6):635-640. doi:10.1191/1352458505ms1215oa
19. Marrie R, Horwitz R, Cutter G, Tyry T, Campagnolo D, Vollmer T. Comorbidity, socioeconomic status and multiple sclerosis. *Mult Scler*. 2008;14(8):1091-1098. doi:10.1177/1352458508092263
20. Vasileiou ES, Filippatou AG, Pimentel Maldonado D, et al. Socioeconomic disparity is associated with faster retinal neurodegeneration in multiple sclerosis. *Brain*. 2021;144(12):3664-3673. doi:10.1093/brain/awab342
21. Pimentel Maldonado DA, Eusebio JR, Amezcua L, et al. The impact of socioeconomic status on mental health and health-seeking behavior across race and ethnicity in a large multiple sclerosis cohort. *Mult Scler Relat Disord*. 2022;58:103451. doi:10.1016/j.msard.2021.103451
22. Abbatemarco JR, Carlson A, Ontaneda D, et al. Association of socioeconomic disadvantage and neighborhood disparities with clinical outcomes in multiple sclerosis patients. *Mult Scler Relat Disord*. 2022;61:103734. doi:10.1016/j.msard.2022.103734
23. Orlando CM, Pérez CA, Agyei P, et al. Social determinants of health and disparate disability accumulation in a cohort of Black, Hispanic, and White patients with multiple sclerosis. *Mult Scler*. 2023;29(10):1304-1315. doi:10.1177/13524585231185046
24. Bebo B, Cintina I, LaRocca N, et al. The economic burden of multiple sclerosis in the United States: estimate of direct and indirect costs. *Neurology*. 2022;98(18):e1810-e1817. doi:10.1212/WNL.0000000000200150
25. Harding KE, Wardle M, Carruthers R, et al. Socioeconomic status and disability progression in multiple sclerosis: a multinational study. *Neurology*. 2019;92(13):e1497-e1506. doi:10.1212/WNL.0000000000007190
26. Calocer F, Dejardin O, Kwiatkowski A, et al. Socioeconomic deprivation increases the risk of disability in multiple sclerosis patients. *Mult Scler Relat Disord*. 2020;40:101930. doi:10.1016/j.msard.2020.101930
27. Marshall MC Jr. Diabetes in African Americans. *Postgrad Med J*. 2005;81(962):734-740. doi:10.1136/pgmj.2004.028274
28. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of obesity and severe obesity among adults: United States, 2017-2018. *NCHS Data Brief*. 2020;(360):1-8.
29. Marrie RA, Horwitz RI. Emerging effects of comorbidities on multiple sclerosis. *Lancet Neurol*. 2010;9(8):820-828. doi:10.1016/S1474-4422(10)70135-6
30. Palladino R, Chataway J, Majeed A, Marrie RA. Interface of multiple sclerosis, depression, vascular disease, and mortality: a population-based matched cohort study. *Neurology*. 2021;97(13):e1322-e1333. doi:10.1212/WNL.0000000000012610
31. Fitzgerald KC, Salter A, Tyry T, Fox RJ, Cutter G, Marrie RA. Measures of general and abdominal obesity and disability severity in a large population of people with multiple sclerosis. *Mult Scler*. 2020;26(8):976-986. doi:10.1177/1352458519845836
32. Fitzgerald KC, Damian A, Conway D, Mowry EM. Vascular comorbidity is associated with lower brain volumes and lower neuroperformance in a large multiple sclerosis cohort. *Mult Scler*. 2021;27(12):1914-1923. doi:10.1177/1352458520984746
33. Chase C, Connell E, Elliott SN, et al. Differences in cardiometabolic comorbidities between Black and White persons living with multiple sclerosis. *Arch Phys Med Rehabil*. 2022;103(2):331-335. doi:10.1016/j.apmr.2021.10.011
34. Lutfullin I, Eveslage M, Bittner S, et al. Association of obesity with disease outcome in multiple sclerosis. *J Neurol Neurosurg Psychiatry*. 2023;94(1):57-61. doi:10.1136/jnnp-2022-329685
35. Bailey ZD, Krieger N, Agénor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: evidence and interventions. *Lancet*. 2017;389(10077):1453-1463. doi:10.1016/S0140-6736(17)30569-X

TABLE S1. Factors Associated With EDSS Greater Than 4

	All	White people with MS	Black people with MS	*P* value
Female, n (%)	370 (73.8)	222 (73.0)	148 (75.5)	.536
Avg age of first symptom, y (SD)	34.2 (10.8) n = 500	35.9 (11.3) n = 304	31.6 (9.5) n = 196	< .001
Avg age at diagnosis, y (SD)	36.1 (11.2) n = 500	38.0 (11.6) n = 304	33.3 (9.9) n = 196	< .001
Avg time from symptom onset to diagnosis, y (SD)	1.9 (4.1) n = 499	2.0 (4.0) n = 303	1.7 (4.3) n = 196	.434
Avg time from symptom onset to start of DMT, y (SD)	3.1 (5.5) n = 481	3.3 (5.5) n = 291	2.8 (5.4) n = 190	.347
Average time from diagnosis to start of DMT, y (SD)	1.3 (4.0) n = 481	1.4 (4.3) n = 291	1.1 (3.5) n = 190	.542
Avg n of relapses in first y (SD)	1.1 (0.3) n = 500	1.0 (0.2) n = 304	0.15 (0.4) n = 196	< .001
MS type, n (%) RMS PMS	 420 (84.0) 80 (16.0)	 244 (80.2) 60 (19.8)	 176 (89.8) 20 (10.2)	.005
Avg disease duration, y (SD)	11.5 (8.8) n = 500	12.5 (9.6) n = 304	9.8 (7.2) n = 196	< .001
Hospitalized with first attack, n (%)	230 (46.0)	94 (30.9)	136 (69.3)	< .001
EDSS at diagnosis, n (%) 0-3.5 4-5.5 6 or >	 382 (76.4) 97 (19.4) 21 (4.2)	 248 (81.6) 48 (15.8) 8 (2.6)	 134 (68.4) 49 (25.0) 13 (6.6)	.002
Last EDSS, n (%) 0-3.5 4-5.5 6 or >	 259 (51.8) 94 (18.8) 146 (29.2)	 187 (61.5) 42 (13.8) 75 (24.7)	 72 (36.7) 52 (26.5) 71 (36.2)	< .001
Transverse myelitis, n (%)	178 (35.6)	96 (31.6)	82(41.8)	.019
Visual loss at disease onset, n (%)	162 (32.4)	87 (28.6)	75 (38.3)	.024
Ambulatory assistance at diagnosis, n (%) 0 1 2 3	 354 (70.8) 53 (10.6) 38 (7.6) 55 (11.0)	 229 (75.3) 31 (10.2) 18 (5.9) 26 (8.6)	 125 (63.8) 22 (11.2) 20 (10.2) 29 (14.8)	.024
Insurance, n (%) Private insurance Medicare and/or Medicaid Self-pay insurance Multiple insurance	 266 (53.2) 154 (30.8) 14 (2.8) 66 (13.2)	 166 (54.6) 92 (30.3) 5 (1.6) 41 (13.5)	 100 (51.0) 62 (31.6) 9 (4.6) 25 (12.8)	.250
Zip code-based average AGI category, n (%) 2 3 > 3	 194 (38.8) 162 (32.4) 144 (28.8)	 80 (26.3) 116 (38.2) 108 (35.5)	 114 (58.2) 46 (23.5) 36 (18.4)	< .001
Comorbidity, n (%) HTN DM Smoking	 225 (45.0) 63 (12.6) 150 (30.0)	 129 (42.4) 32 (10.5) 99 (32.6)	 96 (49.0) 31 (15.8) 51 (26.0)	 .151 .082 .119
Average BMI at diagnosis (SD)	30.8 (8.7) n = 500	29.6 (8.3) n = 304	32.6 (8.9) n = 196	< .001
Initial HE DMT (ie, NTZ, OCR, OFA), n (%)	88 (17.6)	51 (16.8)	37 (18.9)	.547
Time of capture HE DMT (ie, NTZ, OCR, OFA, ALM), n (%)	245 (49.0)	149 (49.0)	96 (48.9)	.994

ALM, alemtuzumab; AGI, adjusted gross income (coded as 1 < $25,000, 2 = $25,000-$50,000, 3 = $50,000-$75,000, and > 3 ≥ $75,000 per year); avg, average; BMI, body mass index; DM, diabetes mellitus; DMT, disease-modifying therapy; EDSS, Expanded Disability Status Scale; HE, high-efficiency; HTN, hypertension; n, number; NTZ, natalizumab; OCR, ocrelizumab; OFA, ofatumumab; PMS, progressive multiple sclerosis; RMS, relapsing multiple sclerosis; y, year.