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Racial and Socioeconomic Disparities in Parkinsonism

J. Patrick Hemming, MD; Ann L. Gruber-Baldini, PhD; Karen E. Anderson, MD; Paul S. Fishman, MD, PhD; Stephen G. Reich, MD; William J. Weiner, MD; Lisa M. Shulman, MD

Objective: To assess potential racial and socioeconomic disparities in patients with parkinsonism treated at a tertiary Movement Disorders Center.

Methods: Patients with parkinsonism were evaluated for demographics (age, race, annual income, and educational level), medical comorbidities, medication regimen, disability (Older Americans Resources and Services subcale), presence of Parkinson disease, and disease severity (Unified Parkinson Disease Rating Scale). Disability and disease severity measures were compared by race, income, and educational level using analysis of variance for continuous variables and χ^2 tests for dichotomous variables.

Results: The sample included 1159 patients with parkinsonism (93.4% white, 6.1% African American, 61.2% who earned more than $50 000 annually, 62.7% who completed college, and 79.2% with a diagnosis of Parkinson disease). Cross-sectional analyses by race, income, and educational level showed greater disability and disease severity in African American compared with white patients (African American vs white Older Americans Resources and Services subscale total score, 29.8 vs 25.3, $P=.005$; Unified Parkinson's Disease Rating Scale total score, 53.0 vs 42.8; $P<.001$). African Americans were less likely to be prescribed dopaminergic medications, particularly newer agents (African Americans 20.6% vs whites: 41.1%; $P=.01$). Lower income and lower educational level were independently associated with greater disease severity and disability ($P<.003$).

Conclusion: Racial and socioeconomic disparities exist among patients with parkinsonism being treated at a tertiary Movement Disorders Center. African Americans and those with lower socioeconomic status have greater disease severity and disability than whites. These disparities may be because of problems in diagnosis, access to care, physician referrals, and patient attitudes regarding the appropriate threshold for seeking treatment at a specialized center. Understanding and correction of these disparities may improve outcomes.

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Author Affiliations: Departments of Neurology (Drs Hemming, Anderson, Fishman, Reich, Weiner, and Shulman) and Psychiatry (Dr Anderson), School of Medicine; and Division of Gerontology, Department of Epidemiology and Public Health (Dr Gruber-Baldini), University of Maryland, Baltimore.

IDENTIFYING AND ADDRESSING widespread health disparities in the United States is an issue of major significance. Elimination of health disparities is 1 of 2 major themes of Healthy People 2010 (US Department of Health and Human Services).[1] Racial minorities and people with lower socioeconomic status (SES) have inferior health outcomes for many medical conditions, including diabetes mellitus, heart disease, and Alzheimer disease.[2] Minority patients and those with lower SES tend to present later in the course of the disease and are less likely to have regular follow-up from primary care or specialist physicians.[3] The effect of race and SES on patients with parkinsonism is only beginning to be evaluated.

Parkinsonism is characterized by bradykinesia, tremor, and rigidity. As many as one-third of elderly Americans have features of parkinsonism.[4] Its causes are numerous[5] and most are irreversible. The most common cause of parkinsonism is Parkinson disease (PD), a debilitating, chronic, progressive neurodegenerative disorder with an incidence rate that increases with age.[6,7] Since the introduction of levodopa in 1967, numerous additional pharmacologic therapies have been introduced,[8,9] including dopamine receptor agonists, monoamine oxidase inhibitors, and catechol-*O*-methyltransferase inhibitors.[10] Judicious use of these agents alleviates symptoms and delays disability.

It is unclear whether the incidence and prevalence of PD is the same in white and African American populations in the United States. Studies to assess the prevalence of PD in African American populations show varied results.[11,12] A review of 20 studies[13] concluded that differences in prevalence in African Americans com-

Table 1. Patient Characteristics by Race, Income, and Educational Level

Characteristic	No.	Age, y, Mean	CIRS-G Total Score	MMSE Score	PD, %	Years Since Diagnosis[a]	First Visit, %[b]
Race[c]							
White	1024	67.0	5.2	27.6	79.5	5.3	59.8
African American	66	67.1	6.0	27.0	75.8	6.0	59.1
Annual income, $[d]							
<30 000	157	69.7[g]	6.3[g]	26.8[g]	73.2[f]	7.1[f]	58.6
30 000-50 000	166	67.7[g]	5.5[g]	27.1[g]	76.5[f]	5.7[f]	52.4
50 001-70 000	125	64.6[g]	5.2[g]	28.1[g]	79.2[f]	4.0[f]	59.2
>70 000	384	63.7[g]	4.5[g]	28.6[g]	86.2[f]	4.7[f]	56.0
Educational level[e]							
<College	423	68.8[g]	5.6[f]	26.6[g]	74.7[f]	5.8	62.7
≥College	712	65.7[g]	5.0[f]	28.3[g]	82.6[f]	5.0	57.7

Abbreviations: CIRS-G total, the total number of comorbid conditions, as measured by the Cumulative Illness Rating Scale–Geriatrics score, grouped by organ system; PD, Parkinson disease.
[a] Data missing for 192 patients.
[b] The observed visit is the patient's first evaluation at the University of Maryland Movement Disorders Center.
[c] Data missing for 69 patients.
[d] Data missing for 327 patients.
[e] Data missing for 24 patients.
[f] $P < .01$.
[g] $P < .001$.

pared with European populations remain unproven. Some evidence suggests that PD is underdiagnosed in African Americans.[14] The objective of this study is to assess the presence of differences in disease severity and disability in patients with parkinsonism treated at a tertiary Movement Disorders Center based on race, annual income, and educational level.

METHODS

Data were obtained from patients evaluated by movement disorder specialists (P.S.F., S.G.R., W.J.W., and L.M.S.) at the University of Maryland Movement Disorders Center between May 20, 2003, and July 10, 2008. On their initial visit to the clinic, patients were invited to participate in the Quality of Life & Function Study. The study protocol was approved by the University of Maryland Institutional Review Board, and 72.9% of whites and 56.9% of African Americans agreed to participate. Information was obtained from 3 sources: patient-reported measures, documented medical history, and neurologic examination.

Study participants completed a demographics questionnaire for age, time since diagnosis of parkinsonism, and self-identified race, household income, and educational level. Patients completed a modified version of the Older Americans Resource and Services disability subscale (OARS).[15] This subscale assesses the level of difficulty for 14 daily activities, including 7 activities of daily living and 7 instrumental activities of daily living. A more detailed description of the modified OARS is available.[16] If patients were unable to complete the questionnaire, a family member or caregiver completed it. Because parkinsonism may be characterized by fluctuation of symptoms, patients were instructed to provide 2 responses describing their best and worst level of functioning. Data analysis was based on an average of the best and worst ratings on each OARS item for each patient.

Data regarding current medications were obtained from the patient's medical history. The level of medical comorbidity was assessed with the Cumulative Illness Rating Scale–Geriatrics (CIRS-G), with the score based on the number and severity of medical disorders by organ system.[17] Medications were categorized by class, including dopaminergic medications and antipsychotics. Dopaminergics were subcategorized into carbidopa-levodopa only vs newer medications such as carbidopa-levodopa-entacapone or the dopamine receptor agonists. Among all patients with parkinsonism, PD was specifically diagnosed by a movement disorder specialist. The Unified Parkinson's Disease Rating Scale (UPDRS)[18] was used to assess the severity of parkinsonian signs in all patients.

Data were analyzed using SAS 9.1 statistical software (SAS Institute Inc, Cary, North Carolina). Disability and disease severity measures were compared by race, income, and educational level using analysis of variance for continuous variables and χ^2 tests for dichotomous variables. Similar general linear models were used to examine differences among race, income, and educational level groups, unadjusted (analysis of variance) and adjusted for variables found to be different between the groups (analysis of covariance), including age, CIRS-G total score, time since diagnosis, and presence of PD. The Mini-Mental State Examination score was not included in adjusted models (it was associated with educational level) because of concerns that the test itself may be 1 potential cause for the observed outcome differences (on the causal pathway).

RESULTS

A total of 1090 patients with parkinsonism were evaluated between May 20, 2003, and July 10, 2008. Patient characteristics (ie, age, comorbidity, Mini-Mental State Examination score, diagnosis, and years since diagnosis) by race, income, and educational level are presented in **Table 1**. Sixty-six patients with parkinsonism self-identified their race as African American. Lower SES was associated with being older and having greater medical comorbidity, lower cognitive ability, less likelihood of PD, and longer duration of illness. Although differences existed between African Americans and whites in level of medical comorbidity (ie, CIRS-G score), the difference was not significant ($P = .10$).

The OARS and UPDRS scores differed by race, income, and educational level (**Figure**). Most patients (57.4%) com-

pleted self-report forms independently and 40.7% of the total required help. The proportion of patients completing the study questionnaires varied by race but not by educational level or income. For example, for the OARS disability scale, 16.9% of whites and 26.7% of African Americans failed to complete the questionnaire. Variations in completion rates are reported in **Table 2** and **Table 3**. African Americans had greater disability and disease severity (Table 2). The largest differences were seen on the UPDRS (UPDRS motor score: 27.9 vs 35.1, $P<.001$ and UPDRS total score: 42.8 vs 53.0; $P<.001$). Covariate analysis controlling for age, CIRS-G score, time since diagnosis, and diagnosis of PD widened the gaps between African Americans and whites (UPDRS total score: 51.4 vs 40.6, $P=.002$; OARS total score: 29.3 vs 23.3, $P<.001$).

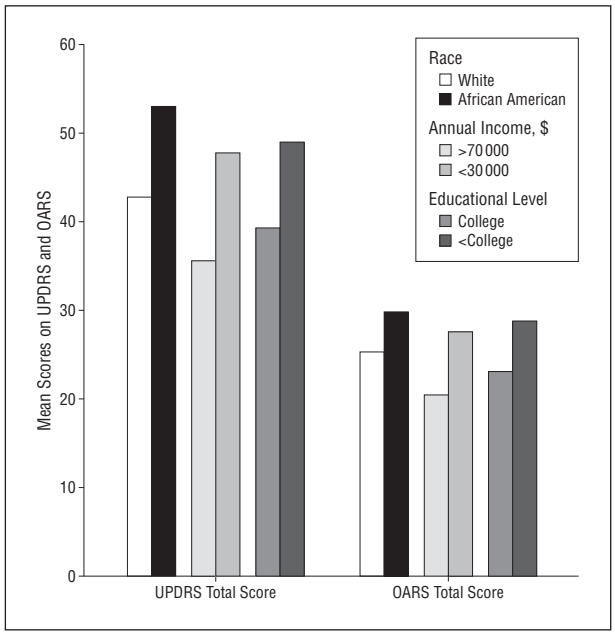

Figure. Disease severity (Unified Parkinson Disease Rating Scale [UPDRS] score) and disability (Older Americans Resources and Services [OARS] subscore) by race, income, and educational level. For overall differences, $P<.001$ for each outcome.

Across all measures of disease severity and disability, significant differences were seen by income and educational level (Table 2). Between high (>$70 000) and low (<$30 000) income groups, the UPDRS total score differed by nearly 15 points (35.6 vs 50.4; $P<.001$) and the total OARS scores were nearly 10 points apart (29.9 vs 20.5; $P<.001$). After controlling for age, CIRS-G score, percentage with PD, and time since diagnosis, significant but less pronounced differences persisted (6.7-point difference in UPDRS, $P<.001$; 5.3-point difference in OARS, $P<.001$). College-educated patients had less disease severity and disability, with scores 10 points lower on the UPDRS total (49.0 vs 39.3; $P<.001$) and 5 points lower on the OARS total (28.8 vs 23.1; $P<.001$). After controlling for covariates, differences diminished but remained significant (7.1-point difference in UPDRS, $P<.001$; 3.6-point difference in OARS, $P<.001$).

Table 3 presents the relationship between race, income, and educational level and disease severity and disability. Within race, trends persisted, but significance disappeared for all the variables except OARS activities of daily living score (African American, 13.8, vs white, 12.2, $P=.046$). This finding may be accounted for by the small number of African American patients. Results remained significant across all variables by income ($P\leq.001$). Differences related to educational level also remained significant (all $P<.01$).

Table 4 presents the comparative use of medications. At the initial visit to the Movement Disorders Center, African Americans were prescribed fewer antiparkinsonian medications (61.9% vs 77.6%; $P=.004$). African Americans were also receiving fewer new dopaminergic agents (catechol-*O*-methyltransferase inhibitors, dopamine agonists, or monoamine oxidase inhibitors, 20.6% vs 41.1%; $P=.001$). The administration of antipsychotic medications was higher in African Americans (12.7% vs 6.1%; $P=.04$).

Table 2. Disability and Disease Severity of Patients Grouped by Race, Income, and Educational Level[a]

Characteristic	No.	OARS Total Score	OARS ADL Score	OARS IADL Score	UPDRS Motor Score	UPDRS Total Score
Race						
White	1024	25.3	12.2	13.3	27.9	42.8
African American	66	29.8[c]	14.3[c]	15.8[b]	35.1[d]	53.0[d]
Annual income, $						
<30 000	157	29.9[d]	14.0[d]	16.2[d]	32.9[d]	50.4[d]
30 000-50 000	166	27.6	13.1	14.7	31.2	47.8
50 001-70 000	125	23.6	11.5	12.3	25.4	39.0
>70 000	384	20.5	10.3	10.5	23.7	35.6
Educational level						
<College	423	28.8[d]	13.6[d]	15.5[d]	31.9[d]	49.0[d]
≥College	712	23.1	11.3	12.0	25.7	39.3

Abbreviations: ADL, activities of daily living; IADL, instrumental activities of daily living; OARS, Older Americans Resource and Services disability subscale; UPDRS, Unified Parkinson Disease Rating Scale.

[a] On the OARS and UPDRS, higher scores indicate greater disability or greater disease severity. The OARS total scale ranges from 14 (no disability) to 70 (completely unable to perform the activities). On the ADL and IADL subscales, the score ranges from 7 (no disability) to 35 (completely unable to perform the activities). The UPDRS rates 35 features of parkinsonism on a scale of 0 (no symptoms) to 4 (severe symptoms). The motor subscale is a set of 14 items representing a total possible score of 108. Total UPDRS score ranges from 0 to 176.

[b] $P<.05$.

[c] $P<.01$.

[d] $P<.001$.

Table 3. Adjusted Means by Race, Income, and Educational Level After Controlling for the Other 2 Variables[a]

Characteristic	No.	OARS Total Score (n=778)	OARS ADL Score (n=773)	OARS IADL Score (n=772)	UPDRS Motor Score (n=778)	UPDRS Total Score (n=778)
Race (controlling for income and educational level)						
White	734	25.4	12.2	13.5	28.5	43.4
African American	44	28.9	13.8	15.3	31.8	48.2
P value for race		.05	.046	.08	.09	.11
Annual income, $ (controlling for race and educational level)						
<30 000	147	30.5	14.4	16.4	33.6	51.3
30 000-50 000	155	28.8	13.6	15.3	32.3	49.4
50 001-70 000	116	26.1	12.6	13.7	28.3	42.8
>70 000	360	23.2	11.5	12.0	26.4	39.5
P value for income		<.001	<.001	<.001	<.001	<.001
Educational level (controlling for race and income)						
<College	266	28.7	13.7	15.2	32.0	48.5
≥College	512	25.6	12.3	13.5	28.2	43.0
P value for educational level		.002	.002	.002	<.001	.001

Abbreviations: ADL, activities of daily living; IADL, instrumental activities of daily living; OARS, Older Americans Resource and Services disability subscale; UPDRS, Unified Parkinson Disease Rating Scale.

[a] Numbers in this table differ from Table 2 because there were only 778 patients with complete data for race, educational level, and income. Number of patients missing any demographic information was 381. Missing data were in the following categories: income (n=327), race (n=69), and educational level (n=24); numbers will not sum to 381 because some characteristics are missing multiple demographic data.

Table 4. Medications by Race, Educational Level, and Income[a]

Characteristic	No.	Antiparkinsonian Medications[b]	New DA[c]	CD/LD[d]	Antid/Anx	Antipsychotics	Dementia[e]
Race							
White	963	77.6[g]	41.1[g]	61.2	22.3	6.1[f]	4.9
African American	63	61.9[g]	20.6[g]	55.6	19.1	12.7[f]	3.2
Annual income, $							
<30 000	150	76.7	30.0[g]	67.3[f]	30.0[g]	12.0[h]	4.7[f]
30 000-50 000	156	77.6	37.2[g]	66.0[f]	28.2[g]	10.3[h]	6.4[f]
50 001-70 000	121	71.9	38.8[g]	53.7[f]	20.7[g]	5.0[h]	1.7[f]
>70 000	360	77.8	47.2[g]	56.7[f]	17.8[g]	1.9[h]	1.9[f]
Educational level							
<College	402	74.4	35.3[f]	60.2	25.6[f]	8.4[f]	5.2
≥College	667	76.9	43.0[f]	60.3	19.3[f]	4.7[f]	4.0

Abbreviations: Antid/Anx, antidepressants/anxiolytics; CD, carbidopa; DA, dopamine agonists; LD, levodopa.

[a] Numbers in this table differ from those in Table 2 because some participants (n = 66) were missing medication coding in the database.

[b] Includes CD/LD, DAs, monoamine oxidase inhibitors, catechol-*O*-methyltransferase inhibitors, anticholinergics, amantadine, and apomorphine.

[c] Includes apomorphine, entacapone, pramipexole, ropinirole, rasagiline, rotigitine, and selegiline.

[d] Includes patients prescribed LD as their sole dopaminergic therapy.

[e] Includes donepezil hydrochloride, rivastigmine, galantamine hydrobromide, and nemantine hydrochloride.

[f] $P<.05$.

[g] $P<.01$.

[h] $P<.001$.

Income was not associated with a difference in the overall use of antiparkinsonian medications; however, 30.0% of patients with incomes less than $30 000 were prescribed newer dopaminergic agents, compared with 47.2% of those making more than $70 000 ($P=.002$). The use of carbidopa-levodopa without newer adjunctive agents was more common in the lower-income population (67.3% in the <$30 000 group and 56.7% in the >$70 000 group, $P=.03$). Lower-income patients were also more likely to be prescribed antidepressants ($P=.004$), antipsychotics ($P=.001$), and antidementia agents ($P=.03$) (Table 4).

Antiparkinsonian medication use was similar across educational levels except for a difference in the use of newer agents (35.3% with less than a college education vs 43.0% with a college education, $P=.002$). Patients with lower educational level were more likely to be prescribed antipsychotics (8.4% with less than a college education vs 4.7% with a college education, $P=.01$).

COMMENT

Evidence of health disparities in PD is growing. Cheng et al[19] examined quality indicators at medical follow-up among veterans with PD and found that non-Hispanic white patients were more likely than minorities to receive care that adhered to certain quality indicators, particularly treatment of depression.

Dahodwala et al[20] abstracted data from the Pennsylvania Medicaid claims bank and reported that African Americans were half as likely to be diagnosed as having PD as whites. After controlling for age, sex, and geography, African Americans were 4 times less likely to receive any treatment for PD.[21] Yacoubian et al[22] found that among the cohort of patients in the Reasons for Geographic and Racial Differences in Stroke study, whites were nearly twice as likely to be prescribed medication for PD.

Our study shows that race and SES influence disease severity and disability related to parkinsonism among patients being treated at an academic Movement Disorders Center. African Americans had greater parkinsonian disease severity and disability than whites, and significant differences in management were also seen based on race and SES. These findings may be explained by delayed diagnosis, referral patterns, access to care, economic factors, or a combination of all these.[23,24]

The demographic makeup of the study sample illustrates important disparities. The University of Maryland Movement Disorders Center is located in Baltimore, where 64% of the population is African American, mean household income is approximately $30 000, and high school dropout rates are high.[25] In contrast, the patient population of the Movement Disorders Center is 93.4% white, 61.2% earn more than $50 000, and 62.7% have completed college. These discrepancies suggest that minorities and those with low SES are less likely to receive specialized care.

The African American and white populations in our study were similar in age, cognitive function, percentage with PD, and years since diagnosis, thereby eliminating these potential confounders. Nonetheless, this study shows greater severity of parkinsonian signs, symptoms, and disability in African Americans. These differences do not persist when income and educational level are controlled, but this may be because of the relatively small number of African Americans.

Parkinson disease severity was higher in African Americans than whites. African Americans scored 10 points higher on the total UPDRS than whites. This is a striking difference that may influence mortality. Wilson et al[26] showed among older Catholic nuns and priests that each higher point on the UPDRS scale was associated with a risk ratio of 1.1 for death within the 7-year study period. Perhaps African Americans or their physicians have a higher threshold for seeking treatment at a specialized center. This threshold may relate to perceptions of parkinsonian symptoms within the African American population. Studies have shown that African Americans and other minorities may perceive common medical conditions as natural processes that do not require medical intervention.[27,28]

Physicians may consciously or unconsciously contribute to health disparities. Race, educational level, and SES may be factors in physician decision-making regarding referral to a specialist for consultation.[29] Bach et al[30] reported that differences also exist between the primary care physicians whom African Americans visit and those whom whites visit. Physicians may be influenced by unconfirmed reports that PD is less common in African American populations. Our study shows that African Americans are less likely to receive antiparkinsonian medications and less likely to receive the newer medications on the market. There was no disparity in the use of antiparkinsonian medications by income or educational level, although lower SES groups were also less likely to receive newer agents. This finding suggests that the racial disparity in PD management is not fully explained by income or educational level. Other factors may include physician decision-making, patient acceptance of medications, and access to care. The increased use of antipsychotics in elderly African American patients seen in our study has been reported previously.[31]

Disparities by income and educational level have been reported in other populations. Lleras-Muney[32] demonstrated that life expectancy was lengthened by as much as 1.7 years for each extra year of schooling. In our study, income and educational level, when controlled for each other and for race, are significantly and independently associated with disease severity.

Differences between total UPDRS scores in high- and low-income patients from the present study reached nearly 15 points. Wilson et al[26] related this magnitude in total UPDRS score to a more than doubling of mortality risk. Although disparities remained after controlling for age and comorbidity, lower-income patients tended to be older and have greater medical comorbidity. This may account partly for the increased use of medications for depression and psychosis.

Several limitations exist in this study. The sample of African Americans is small (n=66) and our ability to detect differences may have been hindered. Not all data were collected from the initial visit at our Movement Disorders Center. This factor is likely to influence medication management and PD severity ratings; however, the proportion of patients receiving initial or follow-up care was similar across groups. The demographics of the center did not permit analysis of racial minorities other than African Americans. Numerous additional factors may confound disparities by SES, limiting conclusions regarding the effects of income and educational level on disability and disease. The generizability of these findings may be limited because our cohort is composed of a select population being referred to a single tertiary center.

The strengths of the study include the size and scope of items contained in the Quality of Life & Function Study database. All patients were examined and diagnosed by neurologists specializing in movement disorders. Future studies should investigate patient attitudes, their beliefs about PD symptoms and therapies, and physician attitudes regarding referral and PD management. This is the first study, to our knowledge, to show health disparities in disease severity and disability in parkinsonism. Studies in different patient populations and geographic locations are necessary to confirm these findings.

Racial and SES disparities are complex phenomena.[33] Parkinsonism reduces quality of life and results in disability and premature mortality. The results of this study suggest we need to better understand the cause of parkinsonism and to find remedies for disparate outcomes among patients with parkinsonian disease who are of different backgrounds and means.

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Correspondence: Lisa M. Shulman, MD, Department of Neurology, University of Maryland School of Medicine, 110 S Paca St, Ste 3-S-127, Baltimore, MD 21201 (lshulman@som.umaryland.edu).
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