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RESEARCH ARTICLE

Racial/ethnic differences in neuropsychiatric disturbances associated with incident dementia

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Abstract

INTRODUCTION: Neuropsychiatric symptoms (NPS) are nearly universal in dementia; some cross-sectional studies of NPS in dementia have found racial/ethnic differences, though it is unknown if NPS prevalence differs among racial/ethnic groups before and after dementia diagnosis.

METHODS: Participants were followed annually at Alzheimer's Disease Centers and were assessed on the Neuropsychiatric Inventory-Questionnaire (NPI-Q) with at least one follow-up visit at which they were diagnosed with dementia. Descriptive statistics were generated by race/ethnicity. NPS were modeled over time as a function of race/ethnicity and with diagnosis date as the baseline.

RESULTS: NPS were present in 95% in at least one time point. After adjusting for covariates, there were no statistically significant differences in NPI-Q total scores among racial/ethnic groups at the time of and after dementia diagnosis.

DISCUSSION: Findings from our prospective cohort study suggest that when individuals are matched at the time of conversion to dementia, there are no racial/ethnic differences in NPS.

KEYWORDS
dementia, ethnicity, neuropsychiatric, race

Highlights

- Neuropsychiatric symptoms of dementia are frequent and increase caregiver burden.
- Prior studies reported more neuropsychiatric symptoms (NPS) in Black compared to White individuals with dementia.
- National Alzheimer's Coordinating Center Black, White, and Hispanic participants did not differ in NPS at the time of dementia diagnosis.

1 | BACKGROUND

Neuropsychiatric symptoms (NPS) are nearly universal in dementia and increase over time.[1–4] These symptoms include affective and motivational changes, such as depression, apathy, and anxiety, as well as psychotic symptoms, sleep disturbances, and disinhibition. Over the course of dementia, NPS are associated with greater functional impairment, increased mortality, higher caregiver burden, and increased risk of institutionalization.[2,5–7] Some NPS precede cognitive disorders and may be a prodrome to dementia.[8–10] NPS occur with various neurodegenerative diseases including Alzheimer's disease (AD), vascular dementia, and frontotemporal dementia. Some studies have found that individuals with AD are more likely to have delusions, while individuals with vascular dementia are more likely to experience depression and apathy, and one of the hallmarks of Lewy body dementia is visual hallucinations.[11] NPS persist throughout the course of dementia and are one of the main reasons caregivers seek out-of-home placement.

Due to disparities in educational opportunities, vascular risk factors, and access to health care, Black and Latinx/Hispanic American populations have a higher prevalence and incidence of mild cognitive impairment (MCI) and dementia than non-Hispanic White (NHW) Americans.[12–14] It has also been found that the proportion of individuals with missed or delayed diagnoses of dementia is higher among Black and Latinx/Hispanic American individuals than among NHW.[15] Less is known, however, about racial/ethnic differences in NPS associated with dementia. It is imperative to characterize differences in dementia characteristics among marginalized groups within the context of socially linked inequities and structural determinants of health. Thus, when discussing racial/ethnic differences in dementia risk, timing of diagnosis, associated conditions, and outcomes, many of these differences can be explained as a product of structural racism and its effect on health.[16] Race is a social construct, and groups have been racialized. Most of the studies that have examined racial/ethnic differences in NPS associated with dementia have been small or cross-sectional. In one of the earliest studies to show NPS differences, Deutsch et al. examined clinic charts of 170 psychiatric patients with probable AD to investigate the relationship between psychotic symptoms and aggression.[17] They reported that a significantly larger proportion (66.7%) of Black patients had delusions, compared to 39.7% of NHW patients. The authors acknowledged that this may not have reflected a true racial/ethnic difference because only a small number of the individuals were Black. In a larger cross-sectional study of 342 patients with AD, one third of the patients had psychotic symptoms—delusions and/or hallucinations—and patients with hallucinations were more likely to be Black than NHW.[18,19]

In addition, in a large study of patients with moderate to severe dementia, Sink et al. found racial/ethnic differences in NPS. In their study of > 5700 community-dwelling adults with dementia and their caregivers, Sink et al. identified that, compared to NHW patients, Black and Latinx/Hispanic American patients had significantly more hallucinations and wandering, among other "dementia-related behaviors."[20]

There are caveats to these findings of more prevalent NPS associated with dementia in underrepresented minoritized populations.

RESEARCH IN CONTEXT

1. **Systematic review**: The authors reviewed the literature using traditional sources (e.g., PubMed). There are few cross-sectional studies on racial/ethnic differences of neuropsychiatric symptoms (NPS) of dementia. These relevant references are appropriately cited.
2. **Interpretation**: When NPS are examined before and after the time of dementia diagnosis, our findings indicate that previous studies finding racial/ethnic differences in NPS associated with dementia could be due to different races/ethnicities presenting later in the disease process, rather than reflecting a true difference in prevalence.
3. **Future directions**: The article proposes a method to examine racial/ethnic differences in NPS associated with dementia. By matching individuals at the time of onset of dementia, future studies can identify why different races/ethnicities may present with different neuropsychiatric disturbances in more nationally representative samples.

Rather than concluding that NPS are truly more prevalent in certain racial/ethnic groups, it is possible that this observation is due to diagnostic delay. Specifically, Black and Latinx/Hispanic American individuals with dementia may present to clinical attention at later stages of disease, having accumulated more NPS.

We will test our hypothesis that previous observations of more NPS among Black people with dementia are due to their presenting to clinical attention later in the disease process by using prospective data from volunteers who join when they are still cognitively normal and are followed regularly. This study aims to compare trajectories of NPS of dementia in different racial/ethnic groups in a cohort of volunteers with longitudinal follow-up. By starting with individuals who have not yet been diagnosed with dementia, this study seeks to minimize contribution of referral bias to racial/ethnic differences in NPS associated with dementia.

2 | METHODS

2.1 | Participants and dementia diagnoses

Participants were volunteers who had been recruited with normal cognition and then followed up approximately annually at Alzheimer's Disease Centers (ADCs), which are funded by the National Institute on Aging and located across the United States. The National Alzheimer's Coordinating Center (NACC) maintains a database of ADC participants' neuropathologic and clinical data.[21,22] To be included in the data analysis, participants had to be 60 years of age or older and with normal cognition (not MCI or dementia) at their first NACC visit

and then receive a diagnosis of dementia at one or more later visits. The participant's self-reported racial/ethnic background also had to be documented at the first or one of the later visits. NACC asks if the participant reports being of Hispanic/Latino ethnicity ("having origins from a mainly Spanish-speaking Latin American country regardless of race") and then asks the participant how they report their race ("White, Black or African American, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, Asian, or other (specify)." NACC permitted use of the publicly available data set.

All ADC participants' data came from the Uniform Data Set (UDS), a standardized set of assessment procedures, including clinical and demographic characteristics, functional and behavioral evaluations, and a neuropsychological battery.[23] Depending on the specific ADC, a local consensus panel or single clinician made the dementia diagnosis based on all available collected data and using recognized criteria (i.e., National Institute on Aging–Alzheimer's Association criteria for AD, consortium criteria for Lewy body dementia, National Institute of Neurological Disorders and Stroke/Association Internationale pour la Recherche et l'Enseignement en Neurosciences criteria for vascular dementia, and Neary criteria for frontotemporal dementia).[24] We chose to include the dementia type diagnosed at the last visit, as opposed to the first visit, as later type designations are made with more longitudinal data. We also considered dementia diagnoses to be "sticky," meaning that once an individual was diagnosed as having dementia, the diagnosis remained even if the individual reverted to an MCI or normal cognition diagnosis. Our logic behind "sticky" diagnoses is multipronged. First, in clinical practice, dementia diagnoses are not typically revisited, so revisiting them in research makes it less applicable to real-world practice. Second, an alternative to "sticky" diagnoses is to use the last available diagnosis, but this is problematic because it assumes that people who are lost to follow-up do not revert. It also would assume that people who have not yet reverted will not revert. Third, the literature indicates that reversions from dementia to MCI or normal cognition occur less frequently than reversions from more severe to moderate or moderate to mild dementia.[25]

2.2 | Measures

NPS were determined from ratings on the Neuropsychiatric Inventory–Questionnaire (NPI-Q), a reliable brief assessment based on the NPI.[26] Certified clinicians and health professionals administered the NPI-Q to collateral informants, who reported their observations of dementia-related NPS, such as anxiety, apathy, depression, delusions, and hallucinations. The informants are asked to report the presence or absence of symptoms that are new to the participant (rather than reflecting chronic psychiatric symptoms) and have occurred within the last 4 weeks prior to assessment. When a NPS is present, the informant is asked to rate the severity of the symptom as 0 (not present), 1 (mild), 2 (moderate), or 3 (severe), with the total NPI-Q severity score ranging from 0 to 36.

2.2.1 | Clinical Dementia Rating

The Clinical Dementia Rating (CDR) rates impairment in six cognitive domains: memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care.[27] Each domain is rated from 0 (no impairment) to 3 (severe), and the sum of boxes is the total of values from all answers, ranging between 0 and 18.

2.2.2 | Framingham Stroke Risk Profile

The Framingham Stroke Risk Profile (FSRP) is a composite score that predicts a 10-year risk of incident stroke based on age, systolic blood pressure, antihypertensive medication use, smoking status, atrial fibrillation, and other cardiovascular problems.[28] We use this measure as a proxy for vascular burden.

2.2.3 | Charlson Comorbidity Index

The Charlson Comorbidity Index (CCI) is a 19-item assessment tool that predicts long-term mortality.[29] Each item or condition has an associated weight, and the sum of the weights makes the total score. Higher scores indicate a greater mortality and more severe comorbid conditions.

2.2.4 | Geriatric Depression Scale

The 15-item Geriatric Depression Scale (GDS-15) assesses depression in 15 questions posed to the participant about his/her feelings.[30] A score > 5 suggests depression.

2.3 | Statistical analysis

Descriptive characteristics for the participants were displayed separately by racial/ethnic group. For NPI-Q total scores, we fit zero-inflated negative binomial (ZINB) models due to a preponderance of zeros. We used zero-inflated Poisson (ZIP) models for the individual symptoms (NPI-Q subscores) due to sparse data.[31] Both models fit the data in two parts; the first part is a logistic regression model in which the outcome is 0 versus > 0. For ZINB models, we fit a negative binomial model to counts > 0, and for ZIP, we fit a Poisson model to counts > 0. We included time, racial/ethnic group, and racial/ethnic group by time interactions. We then fit the models adjusting for age, sex, apolipoprotein E (*APOE*) ε4 allele status, and education, and additional models adjusting for baseline Mini-Mental State Examination (MMSE) score, and then again plus comorbidity index and FSRP10. Because these models are complex and entail fitting the data in two parts, to communicate the association between racial/ethnic group and NPS over time, we calculated fitted values by racial/ethnic group at baseline, 2, and 5

TABLE 1 Participant demographic and clinical characteristics, baseline visit (first diagnosed with dementia).

Factor	Total ($n = 1003$)	Non-Hispanic White American ($n = 847$)	Latinx/Hispanic American ($n = 42$)	Black ($n = 114$)	*P* value
Age, mean (SD)	78.44 (7.42)	78.72 (7.52)	76.43 (7.14)	77.13 (6.48)	0.02[a]
Years of education, mean (SD)	15.92 (7.13)	16.31 (7.52)	12.12 (4.64)	14.39 (3.19)	<0.001[a]
Female	643 (64.1%)	525 (62%)	25 (59.5%)	93 (81.6%)	<0.001[b]
Married	448 (45%)	406 (48.3%)	18 (42.9%)	24 (21.2%)	<0.001[b]
CDR sum of boxes, mean (SD)	4.43 (3.19)	4.39 (3.18)	4.9 (3.11)	4.56 (3.35)	0.53[a]
NPI-Q total, mean (SD)	3.86 (4.07)	3.88 (4.06)	4.05 (4.18)	3.71 (4.15)	0.89[a]
GDS, mean (SD)	3.8 (14.47)	3.85 (14.84)	6.36 (18.8)	2.43 (8.74)	0.31[a]
MMSE total, mean (SD)	24.1 (3.72)	24.47 (3.67)	22 (3.32)	22.38 (3.5)	<0.001[a]
Dementia type:[d] Alzheimer, Vascular, Other	289 (72.4%), 46 (11.5%), 64 (16%)	242 (71.8%), 39 (11.6%), 56 (16.6%)	14 (82.4%), 2 (11.8%), 1 (5.9%)	33 (73.3%), 5 (11.1%), 7 (15.6%)	0.9[c]
CCI total, mean (SD)	1.47 (0.96)	1.43 (0.9)	1.62 (0.7)	1.7 (1.38)	0.011[a]
FSRP10, mean (SD)	0.51 (0.4)	0.49 (0.41)	0.48 (0.4)	0.64 (0.35)	0.005[a]

Abbreviations: CCI, Charlson Comorbidity Index; CDR, Clinical Dementia Rating; FSRP10, Framingham Stroke Risk Profile 10 year; GDS, Geriatric Depression Scale (15 item); MMSE, Mini-Mental State Examination; NPI-Q, Neuropsychiatric Inventory-Questionnaire; SD, standard deviation.
[a]Analysis of variance.
[b]Pearson chi-squared.
[c]Fisher exact test.
[d]At most recent or last visit.

years, based on the model parameter estimates. Full model specification and all parameter estimates are included in supplemental tables in supporting information.

3 | RESULTS

Table 1 includes the baseline demographic characteristics of the total sample ($n = 1003$) categorized by racial/ethnic group. Here baseline refers to their first visit at which they are diagnosed with dementia. There were 847 NHW participants, 114 Black participants, and 42 Latinx/Hispanic American participants. The mean age at this baseline visit was 78.44 (7.42) years, with a mean of 15.92 (7.13) years of education, and a female predominance, particularly in the Black participants. The baseline MMSE ranged from 22 (Latinx/Hispanic American) to 24.47 (NHW). There were no differences in type of dementia (most common being AD), nor in baseline severity of dementia by CDR Sum of Boxes (CDR-SB) score, total NPI-Q score, or GDS score. Small but statistically significant differences in severity of comorbidities among the racial/ethnic groups were present, as demonstrated by the mean CCI scores as well as 10-year risk of stroke by the FSRP scores, with Blacks relative to NHWs having a higher score.

Table 2 shows percentages of people with NPS ever, before, and after dementia diagnosis by racial/ethnic group. NPS were nearly universal, present in > 95% of the sample in at least one time point (before or after dementia diagnosis). A higher proportion of Latinx/Hispanic American participants (59.5%) experienced depression before dementia diagnosis, compared to Black (31.5%) and NHW (47.2%) participants ($P = 0.002$). A smaller proportion of NHW participants (5.4%) experienced delusions before dementia diagnosis, compared to Black (12.6%) and Latinx/Hispanic American participants (19%; $P < 0.001$). More than 54% of Black participants experienced apathy at any time point, compared to 60.6% of NHW participants and 61.9% of Latinx/Hispanic American participants. However, these differences were not statistically significant.

Table 3 shows model-predicted means for NPI-Q total score at baseline, 2, and 5 years from a longitudinal ZIP model with terms for racial/ethnic group, time, and their interaction. Neither Black nor Latinx/Hispanic American participants had statistically significantly different mean scores at any time point, in either the unadjusted or covariate-adjusted model. Table S1 in supporting information shows parameter estimates and Table S2 in supporting information shows fitted change scores by racial/ethnic group for the fully adjusted model.

Table 4 shows model-predicted means for each of the four NPI-Q subdomains at baseline, 2, and 5 years from a longitudinal ZINB model with terms for racial/ethnic group, time, and their interaction. Compared to NHW participants (0.538 [0.483, 0.594]), Latinx/Hispanic American participants (0.774 [0.498, 1.051]) had statistically significantly higher baseline NPI-Q depression scores at baseline ($P = 0.035$), but not at later time points, and not after covariate adjustment. Compared to NHW participants (0.255 [0.161, 0.348]), Black participants (0.103 [0.008, 0.199]) had lower fitted delusion scores at 5 years ($P = 0.026$), but not at other time points and not after covariate adjustment. There were no differences in fitted NPI-Q apathy or hallucination scores at any time point in either the unadjusted or adjusted models. Table S1 shows parameter estimates and Table S2 shows fitted change scores by racial/ethnic group for the fully adjusted model.

TABLE 2 By race/ethnicity, NPI-Q, depression, apathy, delusions, and hallucinations ever, before, and after diagnosed as dementia.

Factor	Non-Hispanic White American *N* = 847	Latinx/Hispanic American *N* = 42	Black *N* = 114	*P* value[a]
NPI-Q > 0, ever	770 (95.1%)	42 (100%)	106 (95.5%)	0.33
NPI-Q > 0, before	642 (79.3%)	36 (85.7%)	81 (73%)	0.17
NPI-Q > 0, after	715 (88.3%)	38 (90.5%)	98 (88.3%)	0.91
NPI-Q > 0 for **depression**, ever	531 (65.6%)	35 (83.3%)	63 (56.8%)	0.008
NPI-Q > 0 for depression, before	382 (47.2%)	25 (59.5%)	35 (31.5%)	0.002
NPI-Q > 0 for depression, after	400 (49.4%)	28 (66.7%)	54 (48.6%)	0.088
NPI-Q > 0 for **apathy**, ever	491 (60.6%)	26 (61.9%)	60 (54.1%)	0.4
NPI-Q > 0 for apathy, before	256 (31.6%)	17 (40.5%)	27 (24.3%)	0.12
NPI-Q > 0 for apathy, after	418 (51.6%)	19 (45.2%)	52 (46.8%)	0.49
NPI-Q > 0 for **delusions**, ever	214 (26.4%)	18 (42.9%)	38 (34.2%)	0.021
NPI-Q > 0 for delusions, before	44 (5.4%)	8 (19%)	14 (12.6%)	<0.001
NPI-Q > 0 for delusions, after	191 (23.6%)	12 (28.6%)	35 (31.5%)	0.16
NPI-Q > 0 for **hallucinations**, ever	119 (14.7%)	10 (23.8%)	23 (20.7%)	0.091
NPI-Q > 0 for hallucinations, before	18 (2.2%)	1 (2.4%)	4 (3.6%)	0.67
NPI-Q > 0 for hallucinations, after	112 (13.8%)	10 (23.8%)	22 (19.8%)	0.065

[a]All assessed using Pearson chi-squared test.
Abbreviation: NPI-Q, Neuropsychiatric Inventory-Questionnaire.

TABLE 3 Fitted means of NPI total scores by race[a].

	Baseline[b]			2 years			5 years		
	Non-Hispanic White American	Latinx/ Hispanic American	Black	Non-Hispanic White American	Latinx/ Hispanic American	Black	Non-Hispanic White American	Latinx/ Hispanic American	Black
NPI-Q total score (95% CI), *p*-value	4.038 (3.754, 4.322)	3.797 (2.735, 4.858) 0.667	4.254 (3.394, 5.115) 0.64	4.187 (3.89, 4.483)	4.371 (3.097, 5.644) 0.783	4.771 (3.736, 5.805) 0.288	4.419 (3.701, 5.138)	4.589 (.813, 8.364) 0.931	5.168 (3.142, 7.195) 0.495
Adjusted for covariates	3.684 (2.484, 4.885)	3.587 (1.763, 5.411) 0.891	3.998 (2.367, 5.63) 0.561	3.887 (2.577, 5.197)	4.252 (2.161, 6.343) 0.656	4.432 (2.659, 6.205) 0.348	4.204 (2.499, 5.909)	4.811 (0.021, 9.601) 0.801	5.171 (2.313, 8.028) 0.448

Note: Calculated *P* values are for differences between that race and White, non-Hispanic, at each time point.
[a]Based on ZIP model that is adjusted for covariates (age, sex, apolipoprotein E ε4 status, education, MMSE, CCI total, FSRP 10).[b]Baseline is baseline visit when individual first diagnosed with dementia.
Abbreviations: CCI, Charlson Comorbidity Index; FSRP 10, Framingham Stroke Risk Profile 10 year; MMSE, Mini-Mental State Examination; NPI-Q, Neuropsychiatric Inventory-Questionnaire; ZIP, zero-inflated Poisson.

4 | DISCUSSION

In this prospective cohort study, we set out to compare the emergence of NPS of dementia in different racial/ethnic groups. We used prospective data to test our hypothesis that Black individuals have more NPS associated with dementia due to presenting to clinical attention later in the disease process.

In this community sample of volunteer participants recruited at ADCs, we found no significant difference among racial/ethnic groups in NPS at the time of diagnosis of dementia and at 2 and 5 years after the diagnosis. As participants aged and had more comorbidities as measured by the CCI, their total NPI-Q score decreased. By following participants both before and after dementia diagnosis, we did not observe racial/ethnic differences in NPS at the time of diagnosis. Because each participant was regularly assessed, it minimizes the possibility that Black and Latinx/Hispanic American participants have more NPS at dementia diagnosis due to being diagnosed later in the dementia process. Other studies of NPS and dementia have found that Black individuals with dementia have more NPS;[18,32] however, our study suggests that if one follows participants carefully, before and after dementia diagnosis, and catches people at true incidence, a racial/ethnic difference in NPS is not observed.

It is unexpected that we did not observe differences in apathy by racial/ethnic group, given that in general Black individuals have a higher incidence of vascular dementia, and apathy tends to be associated with vascular dementia.[33] However, the study's sample was more

TABLE 4 Fitted means of NPI-Q subscores.

	Non-Hispanic White American			Latinx/Hispanic American			Blak/rrican		
	Baseline	2 years	5 years	Baseline	2 years	5 years	Baseline	2 years	5 years
NPI-Q, **depression** severity (95% CI), *P* value	0.538 (0.483, 0.594)	0.471 (0.417, 0.525)	0.381 (0.282, 0.481)	0.774 (0.498, 1.051) 0.035	0.461 (0.283, 0.639) 0.92	0.21 (0.013, 0.433) 0.168	0.437 (0.279, 0.595) 0.691	0.511 (0.294, 0.728) 0.727	0.293 (0.056, 0.53) 0.500
Adjusted for age, sex, *APOE* ε4 status, education, MMSE, CCI, FSRP10	0.259 (0.008, .51)	0.297 (0.068, 0.526)	0.296 (0.1, 0.492)	0.379 (−0.055, 0.813) 0.446	0.218 (−0.083, 0.519) 0.471	0.086 (−0.125, 0.297) 0.105	0.159 (−0.073, 0.392) 0.122	0.144 (−0.073, 0.36) 0.037	0.121 (−0.089, 0.33) 0.145
NPI-Q, **apathy** severity (95% CI), *P* value	0.544 (0.489, 0.598)	636 (0.576, 0.697)	0.803 (0.632, 0.974)	0.443 (0.238, 0.648) 0.077	0.637 (0.371, 0.902) 0.997	1.004 (0.052, 1.955) 0.684	0.504 (0.335, 0.674) 0.152	0.699 (0.506, 0.892) 0.544	0.815 (0.546, 1.084) 0.939
Adjusted for age, sex, *APOE* ε4 status, education, MMSE, CCI, FSRP10	615 (0.343, 0.887)	0.773 (0.389, 1.157)	1.088 (0.386, 1.79)	0.565 (0.152, 0.979) 0.770	0.77 (0.102, 1.437) 0.992	1.039 (−0.92, 2.997) 0.964	0.643 (0.192, 1.094) 0.899	0.782 (0.36, 1.204) 0.959	0.95 (0.315, 1.585) 0.598
NPI-Q, **delusions** severity (95% CI), *P* value	0.232 (0.191, 0.273)	0.241 (0.2, 0.282)	0.255 (0.161, 0.348)	0.211 (0.07, 0.352) 0.684	0.274 (0.043, 0.505) 0.784	0.37(−0.127, 0.867) 0.654	0.337 (0.192, 0.481) 0.212	0.366 (0.18, 0.552) 0.198	0.103 (0.008, 0.199) 0.026
Adjusted for age, sex, *APOE* ε4 status, education, MMSE, CCI, FSRP10	0.182 (0.006, 0.357)	0.201 (0.011, 0.391)	0.232 (−0.009, 0.473)	0.245 (−0.077, 0.567) 0.595	0.175 (−0.056, 0.406) 0.761	0.102 (−0.154, 0.357) 0.375	0.35 (−0.013, 0.713) 0.164	0.36 (−0.021, 0.741) 0.285	0.116 (−0.03, 0.261) 0.378
NPI-Q, **hallucinations** severity (95% CI), *P* value	0.103 (0.075, 0.131)	0.16 (0.121, 0.198)	0.248 (0.151, 0.344)	0.189 (0.046, 0.333) 0.694	0.232 (0.067, 0.398) 0.403	0.31 (−0.132, 0.751) 0.789	0.147 (0.058, 0.236) 0.803	0.23 (0.087, 0.374) 0.35	0.196 (0.043, 0.349) 0.572
Adjusted for age, sex, *APOE* ε4 status, education, MMSE, CCI, FSRP10	0.085 (−0.043, 0.213)	0.129 (−0.051, 0.309)	0.215 (−0.042, 0.473)	0.159 (−0.081, 0.399) 0.418	0.198 (−0.11, 0.505) 0.653	0.082 (−0.105, 0.269) 0.374	0.133 (−0.079, 0.345) 0.448	0.256 (−0.022, 0.535) 0.176	0.178 (−0.084, 0.44) 0.826

Abbreviations: *APOE*, apolipoprotein E; CCI, Charlson Comorbidity Index; CI, confidence interval; FSRP10, Framingham Stroke Risk Profile 10 year; MMSE, Mini-Mental State Examination; NPI-Q, Neuropsychiatric Inventory-Questionnaire.

educated and healthier than the general population, and we did not find more vascular dementia in the Black participants in our cohort; thus, the Black participants in our study may not be representative of the general population, and this could have accounted for the lack of association.[34,35]

Putting our findings in the context of existing literature, other studies have reported racial/ethnic differences in NPS associated with dementia, including an association between being of non-White race and having psychosis; higher levels of anxiety, depression, and apathy in NHW Americans, higher levels of disinhibition in Asian Americans, and higher levels of agitation in Blacks; and more depression in Mexican Americans with AD compared to NHW Americans.[36–38]

We found a greater proportion of Latinx/Hispanic American individuals than other racial/ethnic groups reported depression on the NPI-Q prior to receiving a diagnosis of dementia. One implication of our finding is that clinicians must consider depression on their differential diagnosis when Latinx/Hispanic American individuals present to attention for concerns of dementia. Indeed, even though the National Comorbidity Survey Replication found lower risks of depression among Latinx/Hispanic American individuals compared to NHW, this risk was more pronounced among the younger cohort (age 43 and younger), suggesting depression may become more prevalent as Latinx/Hispanic American individuals age.[39] In addition, a large study of community-dwelling Hispanic participants in Latin America demonstrated high rates of NPS.[40] Although rates of depression were higher in individuals with dementia and parkinsonism, the study found that 27% of older individuals without dementia also endorsed mild symptoms of depression. Finally, analysis of the National Institute of Mental Health's Collaborative Psychiatric Epidemiology Surveys (CPES) data found that Mexican Americans (in addition to Blacks) had significantly higher depression chronicity compared to NHW individuals.[41] Another implication of this finding is that when Latinx/Hispanic American individuals present with depression, more attention should be paid to screening for underlying cognitive impairment, as the depressive symptoms may be a harbinger of future dementia.

Among our limitations include the low number of Latinx/Hispanic American participants in the sample, making it difficult to draw meaningful conclusions about their NPS. The sample is also a highly educated group of healthy participants, limiting its generalizability to the larger population of individuals with dementia. This may have been particularly true for the Black = participants, as described above. As Gleason et al. have discussed in their prior publications, many ADCs recruit from the community to increase enrollment of under-represented groups, such as Black individuals.[42] In contrast, many NHW research participants may have been referred from dementia clinics and are already likely at higher risk for dementia. Thus, systematic differences in enrollment practices bias the conclusions we draw from racial/ethnic differences.[42]

Strengths of our study include the use of a fairly representative large community sample of older adults for which we have data on NPS. We demonstrated the methodological advance of assessing participants prior to their diagnosis of dementia. Doing so allowed us to avoid referral bias, as other studies' findings of racial/ethnic differences in NPS associated with dementia could be due to different racial/ethnic groups presenting later in their dementia course. A competing hypothesis is that Black and Latinx/Hispanic individuals experience health disparities and are generally less healthy than NHW individuals with more vascular disease. When we adjusted for comorbidities (using the CCI and FSRP as proxies), there was some support for this hypothesis, in that some differences in NPS attenuated. A third hypothesized mechanism relates to the observation that Blacks have higher rates of schizophrenia than NHWs.[43] This observation could be due to the pathoplastic effect of discrimination and early life experiences on Blacks' internal experience, that is, that trauma may result in hallucinations or that multiple discriminatory events may change the meaning of daily stressors and contribute to development of delusions. It is also possible that mental health screeners and diagnostic instruments may underestimate symptoms in minoritized populations, as research has found with respect to depression prevalence being low in Black and Latinx/Hispanic individuals.[44,45] Finally, another explanation for racial/ethnic differences in NPS or dementia may reflect cultural differences in reporting NPS, in that some cultures may perceive NPS differently and underreport them compared to other cultures.[20] Similarly, it is imperative to contextualize an individual's experience within their culture or spiritualist belief systems, as some descriptions of psychotic-like experiences may actually reflect spiritual or religious beliefs of the greater culture, rather than a psychotic disorder.[46]

In conclusion, in this prospective cohort study of roughly 1000 volunteers, we followed people prospectively at regular intervals to ensure that there was no bias in diagnosis latency as a function of race, and we did not find any racial or ethnic differences in NPS associated with dementia. This suggests that prior findings of differences in NPS associated with dementia between White and Black individuals could be due to differences in time at which individuals receive their dementia diagnosis. Future prospective studies of representative individuals should examine this hypothesis to further replicate our findings.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest. Author disclosures are available in the supporting information.

CONSENT STATEMENT

Written informed consent is obtained from all NACC participants and co-participants.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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