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Racial Differences in Clinical Presentation in Individuals Diagnosed With Frontotemporal Dementia

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IMPORTANCE Prior research suggests there are racial disparities in the presentation of dementia, but this has not been investigated in the context of frontotemporal dementia (FTD).

OBJECTIVE To explore racial disparities in dementia severity, functional impairment, and neuropsychiatric symptoms in individuals with a diagnosis of FTD.

DESIGN, SETTING, AND PARTICIPANTS This exploratory cross-sectional study of National Alzheimer's Coordinating Center (NACC) data collected between June 2005 to August 2021 evaluated Asian, Black, and White individuals with a diagnosis of FTD (behavioral variant FTD or primary progressive aphasia). Excluded were races with limited data, including American Indian or Alaska Native (n = 4), Native Hawaiian or other Pacific Islander (n = 3), other (n = 13), and unknown (n = 24), and participants with symptom duration more than 4 SDs above the mean.

MAIN OUTCOMES AND MEASURES Racial differences at initial NACC visit were examined on Clinical Dementia Rating Dementia Staging Instrument plus NACC Frontotemporal Lobar Degeneration Behavior & Language Domains (FTLD-CDR), Functional Assessment Scale, and Neuropsychiatric Inventory using regression models. Matching was also performed to address the imbalance between racial groups.

RESULTS The final sample comprised 2478 individuals, of which 59 (2.4%) were Asian, 63 (2.5%) were Black, and 2356 (95.1%) were White. The mean (SD) age at initial visit was 65.3 (9.4) years and symptom duration at initial visit was 67.5 (35.6) months. Asian and Black individuals were considerably underrepresented, comprising a small percent of the sample. Black individuals had a higher degree of dementia severity on FTLD-CDR (β = 0.64; SE = 0.24; *P* = .006) and FTLD-CDR sum of boxes (β = 1.21; SE = 0.57; *P* = .03) and greater functional impairment (β = 3.83; SE = 1.49; *P* = .01). There were no differences on FTLD-CDR and Functional Assessment Scale between Asian and White individuals. Black individuals were found to exhibit a higher frequency of delusions, agitation, and depression (delusions: odds ratio [OR], 2.18; 95% CI, 1.15-3.93; *P* = .01; agitation: OR, 1.73; 95% CI, 1.03-2.93; *P* = .04; depression: OR, 1.75; 95% CI, 1.05-2.92; *P* = .03). Asian individuals were found to exhibit a higher frequency of apathy (OR, 1.89; 95% CI, 1.09-3.78; *P* = .03), nighttime behaviors (OR, 1.72; 95% CI, 1.01-2.91; *P* = .04), and appetite/eating (OR, 1.99; 95% CI, 1.17-3.47; *P* = .01) compared to White individuals.

CONCLUSIONS AND RELEVANCE This exploratory study suggests there are racial disparities in dementia severity, functional impairment, and neuropsychiatric symptoms. Future work must address racial disparities and their underlying determinants as well as the lack of representation of racially minoritized individuals in nationally representative dementia registries.

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Supplemental content

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Frontotemporal dementia (FTD) is a progressive neurodegenerative disease that affects social comportment, executive function, and speech and language.[1] Neuropsychiatric symptoms are exceedingly common in FTD and are a major source of distress for caregivers.[2,3] In the United States, the rate of dementia is highest in Black and Hispanic populations[4]; however, there is little literature on racial differences in FTD. Prior studies have compared neuropsychiatric symptoms in Black and White individuals with dementia, but samples have typically either been composed of patients with Alzheimer disease (AD)[5,6] or were heterogenous dementia samples that were not stratified by dementia type.[7,8] This body of work has demonstrated that compared to White individuals, Black individuals are more likely to show psychotic symptoms,[5,8,9] particularly hallucinations,[6,7,10] and present with a greater degree of functional impairment at the time of an initial visit,[11] highlighting differences in clinical presentation by race in persons with dementia. The etiology of racial differences in the clinical presentation of any form of dementia, and notably atypical forms like FTD, are apt to be multifactorial in origin and based in socioeconomic, structural, and cultural factors associated with race. For example, differential access to health care, diagnostic practices, and/or referral to specialty care, as well as help-seeking intent.[12] Therefore, the purpose of this exploratory study was to examine differences in clinical disease severity, function, and neuropsychiatric symptoms and at initial presentation comparing Asian, Black, and White individuals with a diagnosis of FTD. We used National Alzheimer's Coordinating Center (NACC) data to (1) determine whether clinical disease severity and neuropsychiatric symptoms differ by race and (2) determine if there are differences in functional ability by race.

Key Points

Question Are there racial disparities in dementia severity, functional impairment, and neuropsychiatric symptoms in individuals with a clinical diagnosis of frontotemporal dementia (FTD)?

Findings In this exploratory cross-sectional study of National Alzheimer's Coordinating Center data obtained from 2478 self-reported Asian, Black, and White individuals with a clinical diagnosis of behavioral variant FTD or a primary progressive aphasia, racial differences in level of clinical disease severity, functional impairment, and profiles of neuropsychiatric symptoms were found.

Meaning The reasons for these differences and their implications remain poorly understood, and future work must address disparities in FTD and the systemic and structural determinants that drive them.

Methods

Study Design and Participant Selection

We performed an exploratory cross-sectional, retrospective study of NACC data obtained from self-reported Asian, Black, and White individuals with a clinical diagnosis of behavioral variant FTD or a primary progressive aphasia (PPA). NACC is a public data set established in 1999 by the National Institute on Aging that collects standardized clinical and neuropathological data[13] from Alzheimer's Disease Research Centers across the United States, and the data used in this study were collected from June 2005 to August 2021. Initial visit is the first visit for which each patient had a clinical diagnosis of behavioral variant FTD or PPA including semantic, logopenic, nonfluent/agrammatic variants, or PPA not otherwise specified (**Table**). Some participants received an FTD diagnosis only after their first NACC visit, meaning that their initial visit as defined in this current study was not their first NACC visit. The patient's first NACC visit was not their initial visit for 6.8% of Asian participants, 17.4% of Black participants, and 13.2% of White participants. We selected cases with the following complete outcome data: Clinical Dementia Rating (CDR) Dementia Staging Instrument plus NACC Frontotemporal Lobar Degeneration (FTLD) Behavior & Language Domains (FTLD-CDR),[14] Neuropsychiatric Inventory-Questionnaire (NPI-Q), and demographic variables including race, age, sex, education, and onset of cognitive decline. Symptom duration was calculated as time from the onset of cognitive decline (eg, NACC variable DECAGE) until the initial visit date. We excluded any participant whose symptom duration at initial visit was greater than 4 SDs above the mean symptom duration (>239.6 months). This study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline. Contributing Alzheimer's Disease Research Centers are required to obtain informed consent from their participants or caregivers, and study procedures are approved by local institutional review boards prior to submitting data to NACC.

Clinical Disease Severity, Functional, and Neuropsychiatric Outcomes

FTLD-CDR is completed by a clinician based on informant report and neurological examination. The FTLD-CDR evaluates 8 domains of cognition and function. FTLD-CDR sum of boxes (FTLD-CDR SOB) score is the sum of ratings across domains. Global FTLD-CDR (ie, FTLD-CDR global) indicates the stage of dementia.

The NACC Functional Assessment Scale (FAS) is an informant-rated scale that evaluates ability to perform daily activities. Ratings across the 10 items can be summed to yield an FAS total score ranging from 0 to 30.[15,16] Itemwise analyses, normal, has difficulty, but does by self, and requires assistance were coded as 0, and dependent was coded as 1 for each individual item. The NPI-Q assesses the presence and severity of 12 behaviors common in persons with dementia through a structured interview with the participant's care partner.[17]

Vascular Disease Comorbidities

We extracted vascular disease comorbidity data in individuals for which it was available. The presence of transient ischemic attack, hypertension, stroke, other cardiovascular disease, and diabetes was recorded as absent, recent/active, or

Table. Demographic and Clinical Characteristics of NACC FTD Participants

Characteristic	bvFTD			PPA			Full sample		
	Asian (n = 33)	Black (n = 37)	White (n = 1210)	Asian (n = 26)	Black (n = 26)	White (n = 1146)	Asian (N = 59)	Black (N = 63)	White (N = 2356)
Female, No. (%)	19 (57.6)	20 (54.1)	456 (37.7)	15 (57.7)	21 (80.8)	568 (49.6)	34 (57.6)	41 (65.1)	1024 (43.5)
Male, No. (%)	14 (42.4)	17 (45.9)	754 (62.3)	11 (42.3)	5 (19.2)	578 (50.4)	25 (42.4)	22 (34.9)	1332 (56.5)
Age, mean (SD), y	63.1 (7.7)	65.2 (11.0)	64.0 (10.0)	66.3 (8.5)	68.6 (7.8)	66.6 (8.6)	64.5 (8.1)	66.6 (9.9)	65.2 (9.5)
Education, mean (SD), y	15.4 (3.6)	13.6 (4.2)	15.3 (3.1)	16.6 (3.6)	14.2 (3.1)	15.8 (2.8)	15.9 (3.6)	13.8 (3.8)	15.5 (3.0)
Symptom duration, mean (SD), mo	59.9 (34.7)	62.9 (34.5)	70.5 (39.6)	61.4 (33.4)	67.0 (29.5)	64.7 (30.9)	60.5 (33.8)	64.6 (32.3)	67.7 (35.8)
PPA subtypes, No. (%)	**Asian**			**Black**			**White**		
Semantic PPA	4 (15.4)			1 (3.8)			64 (5.6)		
Logopenic PPA	5 (19.2)			2 (7.7)			114 (9.9)		
Nonfluent/ agrammatic PPA	3 (11.5)			2 (7.7)			65 (5.7)		
PPA not otherwise specified	0			0			44 (3.8)		
PPA primary diagnosis with missing subtype	14 (53.8)			21 80.8)			859 (75.0)		

Abbreviations: bvFTD, behavioral variant frontotemporal dementia; FTD, frontotemporal dementia; NACC, National Alzheimer's Coordinating Center; PPA, primary progressive aphasia.

remote/inactive in the participant's health history. We coded absent as 0 and recent/active or remote/inactive as 1.

Statistical Analysis

Analyses were performed with R Studio version 4.1.0 (R Foundation). Continuous variables are summarized with mean and SD, and univariate regressions were used to assess group differences in demographics. We report differences in clinical disease severity, function, and neuropsychiatric symptom presentation in Asian and Black individuals compared with White individuals using White individuals as the reference population because it was the largest group in the cohort. Two-sided *P* values were statistically significant at .05.

Linear regression examined the association between race and FTLD-CDR SOB, and ordinal logistic regression examined the association between race and FTLD-CDR global. Linear regression examined the association between race and FAS total, and binary logistic regression examined the association between race and each FAS item in a subset of participants with available data. FTLD-CDR and FAS models were adjusted for age, sex, education, and symptom duration.

Logistic regression evaluated the association between race and the presence of each of the 12 neuropsychiatric symptoms and ordinal logistic regression was used to examine the association between race and NPI-Q symptom severity for each of the 12 neuropsychiatric symptoms. Linear regression evaluated the association between race and total NPI-Q and total NPI-Q severity. All NPI analyses were adjusted for age, sex, education, and FTLD-CDR global.

Post Hoc Analyses

To address limitations due to the imbalance in the number of participants in racial groups, we repeated our primary analyses matching each member of underrepresented minority groups (ie, Asian and Black individuals) to 1 or more White individuals. We used a caliper of 0.2 on the standardized distance between matched participants, where this distance was calculated from a generalized linear model with a probit link. A caliper ensures that the matches are similar on covariates, as it ensures that any 2 participants with a standardized distance greater than 0.2 on observed covariates are not matched with one another.[18]

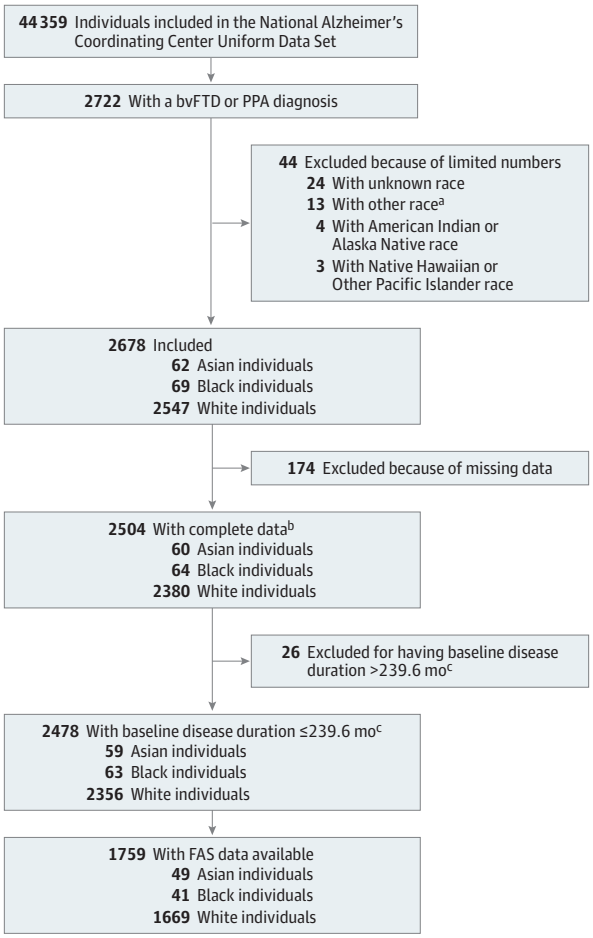
Results

Participant Characteristics

Our final sample was composed of 2478 individuals, of which 59 (2.4%) were Asian, 63 (2.5%) were Black, and 2356 (95.1%) were White (**Figure 1**). In our final sample, no Black individuals, no Asian individuals, and 65 White individuals (2.8%) reported Hispanic ethnicity. Due to limited cases, we excluded all other reported races, including American Indian or Alaska native (n = 4), Native Hawaiian or other Pacific Islander (n = 3), other (n = 13), and unknown (n = 24).

The mean (SD) age at initial visit in Asian, Black, and White individuals was 65.3 (9.4) years, and the mean (SD) symptom duration at initial visit was 67.5 (35.6) months. Age at initial visit and symptom duration did not differ between Asian, Black, and White individuals. Black individuals had fewer years of education (β = −1.72; SE = 0.39; *P* < .001) than White individuals, but Asian and White individuals did not differ in years of education. Asian individuals (odds ratio [OR], 2.42; 95% CI, 1.45-4.16; *P* = .001) and Black individuals (OR, 1.77; 95% CI, 1.05-3.01; *P* = .03) were more likely to be female.

Figure 1. Flow Diagram for Frontotemporal Dementia (FTD) Group



We selected cases with the following complete outcome data: CDR Dementia Staging Instrument plus National Alzheimer's Coordinating Center Frontotemporal Lobar Degeneration Behavior & Language Domains, Neuropsychiatric Inventory–Questionnaire, and demographic variables including race, age, sex, education, and onset of cognitive decline. bvFTD indicates behavioral variant frontotemporal dementia; FAS, Functional Assessment Scale; PPA, primary progressive aphasia.

[a] Other included Brazilian, Egyptian, Hispanic, Mestiza, Norwegian, and multiracial.

[b] Complete data refers to nonmissing data in the following National Alzheimer's Coordinating Center variables: DECAGE, DEL, HALL, AGIT, DEPD, ANX, ELAT, APA, DISN, IRR, MOT, NITE, APP, DELSEV, HALLSEV, AGITSEV, DEPDSEV, ANXSEV, ELATSEV, APASEV, DISNSEV, IRRSEV, MOTSEV, NITESEV, APPSEV, CDRSUM, CDRGLOB, RACE, AGE, SEX, EDUC, VISITMO, VISITDAY, and VISITYR.

[c] Note that 239.6 months is 4 SDs above the mean baseline disease duration (69.8 months).

Clinical Disease Severity

After matching, the NPI and FTLD-CDR analyses included 59 Asian, 63 Black, and 2348 White individuals. Black individuals had higher FTLD-CDR global (β = 0.64; SE = 0.24; *P* = .006) and FTLD-CDR SOB (β = 1.21; SE = 0.57; *P* = .03) after adjusting for age, sex, education, and symptom duration (**Figure 2**). In the matched analysis, Black individuals had higher FTLD-CDR global (β = 0.23; SE = 0.10; *P* = .03) but not FTLD-CDR SOB. Asian individuals did not differ on FTLD-CDR scores compared to White individuals.

Neuropsychiatric Symptoms

As shown in Figure 2, Black individuals in this study exhibited a higher frequency of delusions, agitation, and depression (delusions: OR, 2.18; 95% CI, 1.15-3.93; *P* = .01; agitation: OR, 1.73; 95% CI, 1.03-2.93; *P* = .04; depression: OR, 1.75; 95% CI, 1.05-2.92; *P* = .03). Similarly, we observed that Black individuals had greater symptom severity for delusions (OR, 2.01; 95% CI, 1.10-3.68; *P* = .02), agitation (OR, 1.82; 95% CI, 1.13-2.93; *P* = .01), and depression (OR, 1.61; 95% CI, 1.00-2.57; *P* = .046). In contrast, Black individuals were found to be less likely to exhibit apathy (OR, 0.54; 95% CI, 0.32-0.94; *P* = .03) and showed lower apathy severity (OR, 0.60; 95% CI, 0.37-1.00; *P* = .047) compared to White individuals. Asian individuals were found to exhibit a higher frequency of apathy (OR, 1.89; 95% CI, 1.09-3.78; *P* = .03), nighttime behaviors (OR, 1.72; 95% CI, 1.01-2.91; *P* = .04), and appetite/eating (OR, 1.99; 95% CI, 1.17-3.47; *P* = .01) compared to White individuals. Asian individuals had greater apathy (OR, 1.79; 95% CI, 1.13-2.82; *P* = .01) and appetite/eating severity (OR, 2.19; 95% CI, 1.35-3.56; *P* = .001). When stratifying by behavioral variant FTD or PPA, we observed similar proportions and same direction of neuropsychiatric features (eTable 1 in Supplement 1).

The post hoc matched analysis largely confirmed primary analysis results (eTable 2 in Supplement 1). Black individuals were found to be more likely to exhibit delusions, agitation approached significance, depression approached significance, and Black individuals were less likely to exhibit apathy. Asian individuals were more likely to exhibit apathy, nighttime behaviors, and appetite/eating compared to White individuals.

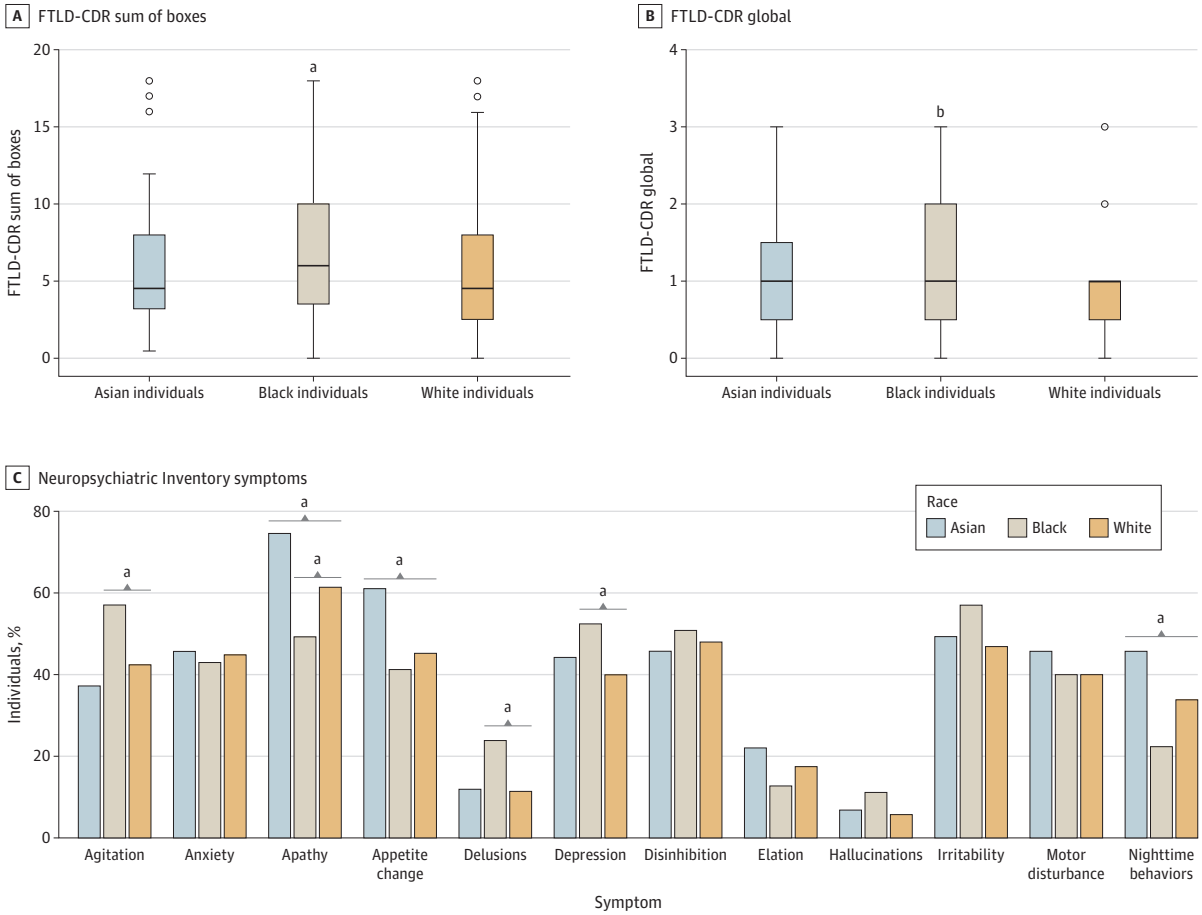
Functional Status

Overall, 49 Asian individuals, 41 Black individuals, and 1669 White individuals had available data on functional status. Black individuals had a higher FAS total (β = 3.83; SE = 1.49; *P* = .01) and the matched analysis confirmed this (β = 3.50; SE = 1.45; *P* = .02). We also observed several differences on FAS individual items (eTable 3 in Supplement 1). Black participants in this study were more likely to have more difficulty with the following: (1) assembling tax records, business affairs, or other papers; (2) heating water, making a cup of coffee, turning off the stove; (3) preparing a balanced meal; (4) keeping track of current events; (5) paying attention to and understanding a TV program, book, or magazine; (6) remembering appointments, family occasions, holidays, and medications; and (7) traveling out of the neighborhood, driving, or arranging to take public transportation. Asian individuals did not have significantly different FAS scores from White individuals.

Vascular Disease Comorbidities

Black individuals were more likely to have hypertension compared to White individuals. Asian individuals were more likely to have diabetes compared to White individuals (eTable 4 in Supplement 1). Hypertension in Black individuals was associ-

Figure 2. Racial Differences in Clinical Dementia Rating Dementia Staging Instrument Plus National Alzheimer's Coordinating Center Frontotemporal Lobar Degeneration Behavior & Language Domains (FTLD-CDR) and Neuropsychiatric Inventory Symptoms at Initial Presentation



[a] $P < .05$.

[b] $P < .01$.

ated with depression (OR, 1.2; 95% CI, 1.01-1.43; $P = .04$) but not delusions or agitation. Diabetes was not associated with neuropsychiatric symptoms in Asian individuals.

Discussion

We examined disparities in clinical disease severity, functional impairment, and neuropsychiatric symptoms in Asian, Black, and White individuals with FTD from the NACC cohort. In this study, we observed that Black individuals had a greater frequency of delusions, agitation, and depression compared to White individuals. Asian individuals had a greater frequency of apathy, nighttime behaviors, and appetite/eating changes compared to White individuals. We also observed that Black individuals had higher levels of clinical disease severity and functional impairment at initial visit compared to White individuals, even though they did not differ in symptom duration. These preliminary findings suggest that there are racialized differences in neuropsychiatric symptoms and the extent of functional impairment.

Neuropsychiatric symptoms are exceedingly common in FTD.[3] To our knowledge, this study is the first to demonstrate differences in neuropsychiatric profiles by race in FTD. A few studies have reported on racial differences in neuropsychiatric symptoms in other dementias such as AD[5,6] and heterogenous sample of dementia.[19] These studies are largely consistent with the findings in this present study whereby Black individuals are more likely to exhibit psychotic symptoms cluster,[5,8,9] including delusions[5,19] and agitation.[19] While delusions and agitation can be associated with advanced dementia, we adjusted our analyses for clinical disease severity and the neuropsychiatric symptoms do not appear to be a reflection of greater disease severity. We observed differences in affective symptoms whereby Black individuals reported greater depression and Asian participants reported greater apathy compared to White participants. Differences in reported rates of depressed mood and apathy may reflect a high degree of phenomenological overlap between apathy and depression, which share multiple features.[20] Future work should use more specific measures of depression and apathy to disentangle potential racial differences in affective symptom presentation.

Considering the diagnosis of FTD is based on clinical symptoms, racial disparities in the recorded presentation of racial minority patients, especially Black individuals, is concerning and may suggest that Black patients with FTD may be at particular risk for misdiagnosis if their symptom profile does not fit within the current clinical criteria.[3] For example in our study, we observed a greater frequency of delusions, agitation, and depression in Black individuals, symptoms that are not currently captured in formal diagnostic criteria. Therefore, changes in FTD diagnostic criteria may be necessary to account for racial differences in neuropsychiatric symptoms.[12]

In this study, Black individuals demonstrated greater levels of functional impairment compared to White counterparts even though symptom duration did not differ between racial groups. Clinician ratings on the FTLD-CDR may be influenced by implicit bias, but Black individuals were also more impaired on the FAS, which is a care partner-rated questionnaire suggesting the severity of functional impairment in Black individuals is not entirely biased by clinician rating. This is in line with prior research showing that Black individuals with dementia show worse performance on measures of cognitive and everyday functioning compared to White individuals.[11,21] One possibility is that Black individuals may delay seeking medical attention for more subtle symptoms associated with aging such as memory decline.[19,22] Studies suggest that social attitudes in the Black community about aging may cause a delay in seeking medical treatment[23]; yet, it may be that certain neuropsychiatric symptoms such as delusions and agitation that can be alarming and pose a danger to patients and caregivers and are difficult to overlook leading to Black caregivers to seek medical attention.

Importantly, Asian and Black individuals were considerably underrepresented in this data set, comprising 2.4% and 2.5%, respectively, of our study sample. Of 36 Alzheimer's Disease Research Centers contributing data to NACC, 14 (38.9%) did not include any Black individuals with FTD and 22 (61.1%) did not include any Asian individuals with FTD. Underrepresentation of Asian and Black patients and others from other minoritized groups impedes the accuracy of population-level research and limits our ability to identify the extent and etiologies of disparities in FTD. The causes of racial disparities in FTD prevalence and symptoms are likely complex and may be interrelated to the causes of racial disparities in health care utilization. There are likely multiple systemic and structural barriers that limit equitable access to health information (such as on symptoms of atypical dementias) and the specialized health care[24,25] needed for timely diagnosis and management of FTD. Even when health information and health care resources are accessible, lack of trust in health systems[26] that has been perpetuated by a history of institutional racism[27] and higher costs associated with the dementia care received by Black individuals may deter health care-seeking behavior.[28] In this context, Babulal et al[10] suggest that Black individuals may choose to delay medical care for the neuropsychiatric symptoms they experience, relying instead on faith-based coping strategies and support from loved ones. To date, the enumeration of racial disparities in ADRD care utilization, in general, demonstrate mixed results.[29-31] Research on the root causes of racial disparities in context-level determinants of health care access and health care utilization is critically needed. This is especially so because FTD specialist care is often linked to research opportunities as well as recognition in registries such as the NACC, which in turn informs population-level understanding of the prevalence and symptomatology of FTD.

Limitations

This study should be interpreted in light of several limitations. First, there is a limited body of research on racial differences in FTD symptoms; therefore, our study goals were exploratory and our results need to be confirmed with more rigorous statistical thresholds. While there were significantly fewer Asian and Black individuals with available data, we used matching to address the imbalance between racial groups and observed similar results as our primary analysis. Dementia-related behaviors are often measured using caregiver report and differences in caregiver characteristics such as sex, race, and education may result in differential reporting of behaviors.[32,33] The FTLD-CDR is a clinician interpretation of the individual's level of functioning and therefore may be subject to unconscious bias exacerbated in the context of inadequate normative data in Black samples.[34] Limitations in power did not allow us to examine differences on neuropsychological measures of cognition but as more data are collected, this may be an important area for future study. We also relied on clinical diagnosis in NACC and confirming these findings in a pathologically defined sample would be an important next step. We analyzed cross-sectional data from initial visit as longitudinal data, which were limited in minority groups, and therefore, we cannot attest to possible longitudinal changes in neuropsychiatric profile and functional decline. We also recognize that our analysis, situated in investigating differences through racial groups is just one of many important comparisons; understanding disparities and the reasons that underlie underrepresentation of minoritized patients in clinical data and participants in clinical research is a much broader gap in current knowledge.

Conclusions

Neuropsychiatric symptoms occur in the adult population[35] and racial differences in psychological symptoms have been reported in healthy individuals.[36,37] We observed that racial differences in neuropsychiatric symptoms from FTD differ from the observed pattern in the healthy controls suggesting that the neuropsychiatric symptom profile observed in Asian and Black individuals is specific to FTD (eTable 5 in Supplement 1). It remains to be determined if the disparities observed in AD and other forms of dementia are the same as those in FTD. As FTD is rarer than AD, any disparities caused by decreased awareness of dementias or caused by decreased access to care might be more pronounced in FTD compared to AD. New knowledge about facilitators and bar-

riers can help researchers develop more effective strategies for engaging currently underrepresented individuals. These findings corroborate existing ADRD research that suggest there are racial disparities in dementia symptoms and functional impairment. The reasons for these differences remain poorly understood. Future work must address disparities in FTD and the systemic and structural determinants that drive them. Efforts to promote equitable access to health care and enrollment in clinical research should be prioritized.

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Concept and design: McMillan, Yannatos, Rhodes, Massimo.
Acquisition, analysis, or interpretation of data: Jin, McMillan, Fisher, Jacoby, Irwin, Massimo.
Drafting of the manuscript: Jin, Rhodes, Massimo.
Critical review of the manuscript for important intellectual content: Jin, Fisher, Massimo.
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