Published in final edited form as:

Dement Geriatr Cogn Disord. 2013 ; 36(0): 310–318. doi:10.1159/000351670.

Caregiver Burden in Frontotemporal Degeneration and Corticobasal Syndrome

Nicole Armstrong^a, Nicole Schupf^{b,c}, Jordan Grafman^d, and Edward D. Huey^{b,c,d}

^aDepartment of Epidemiology, Mailman School of Public Health, College of Physicians and Surgeons, New York, N.Y

^bGertrude H. Sergievsky Center, College of Physicians and Surgeons, New York, N.Y

^cTaub Institute for Research on Alzheimer's Disease and the Aging Brain, College of Physicians and Surgeons, New York, N.Y

^dCognitive Neuroscience Section, National Institute of Neurological Disorders and Stroke, Bethesda, Md., USA

Abstract

Background and Aims—Caregiver stress is often a serious problem when caring for a patient with frontal lobe dysfunction.

Methods—A total of 102 caregivers of both patients with frontotemporal degeneration and corticobasal syndrome completed the Frontal Systems Behavior Scale (FrSBe) and the Zarit Burden Interview (ZBI). To analyze the association between apathy or disinhibition (or both) and caregiver burden, the effects of the total FrSBe and the apathy and disinhibition subscales of the FrSBE on the total ZBI score were assessed with logistic regressions and t tests.

Results—Total FrSBE score and the apathy FrSBE subscore predicted caregiver burden. Apathy occurred without disinhibition, and the two occurred together, but disinhibition without apathy was very rare.

Conclusions—Disinhibition without apathy occurred very rarely. Apathy was more associated with caregiver burden than disinhibition.

Keywords

Caregiver burden; Frontotemporal degeneration; Corticobasal syndrome; Frontal Systems Behavior Scale; Zarit Burden Interview

Introduction

The goal of this study is to determine which behavioral symptoms are associated with increased caregiver burden in frontotemporal degeneration (FTD) and corticobasal

Edward D. Huey, Taub Institute for Research on Alzheimer's Disease and the Aging Brain, 630 West 168th Street, 19th floor, New York, NY 10032 (USA), edh2126@columbia.edu.

Disclosure Statement

None of the authors have conflicts of interest to declare.

syndrome (CBS). Caregiver burden is the ‘multidimensional response to physical, psychological, emotional, social and financial stressors associated with the caregiver experience’ [1]. Behavioral symptoms of dementia have been shown to significantly add to caregiver burden [2]. Caregiver burden is associated with caregiver depression, stress and illness [3, 4]. When compared with counterparts who are not caregivers, caregivers of demented patients are more likely to visit doctor’s offices, take up to 86% more medications and have a higher mortality rate [3, 4]. As frontal lobe dysfunction becomes more severe, caregiver burden increases [2]. As the baby boomer generation ages, caregiver burden will continue to contribute to rising healthcare costs and lower quality of life.

Although caregiver burden has been studied in Alzheimer’s disease (AD), there is little available on caregiver burden in FTD and CBS. Caregivers for FTD patients are generally younger than those for AD patients. Behavioral symptoms in FTD are usually prominent, including apathy and disinhibition [5]. It has been shown that distress for caregivers of FTD patients is higher than caregivers of patients with AD, possibly because behavioral symptoms are usually more prominent in FTD than AD [2, 6]. Little is known about caregiver burden in CBS, an illness that may have combined motor, cognitive and behavioral symptoms [7, 8].

Previous studies on caregiver burden in FTD and CBS have generally used the Neuropsychiatric Inventory (NPI) scale to evaluate behavioral symptoms [2, 7, 9]. The NPI was designed for use in patients with AD. The Frontal Systems Behavior Scale (FrSBe) could potentially be a more accurate measure in the evaluation of FTD and CBS because it was designed to identify early behavioral changes associated with frontal dysfunction [10]. It has adequate normative data for adults, good reliability and the ability to discriminate between frontal lobe lesions and lesions in other areas of the brain [10–13].

To measure caregiver burden, some studies used the health-related quality of life of caregivers. One such study that compared health-related quality of life and coping between caregivers of FTD and AD found that FTD caregivers had greater distress than AD caregivers because FTD patients more often experienced intense neuropsychiatric symptoms [14]. The majority of studies used the Zarit Burden Interview (ZBI) [7, 15, 16]. The ZBI consists of items that evaluate factors of caregiving for dementia patients such as problem-solving abilities, social support (especially from family members) and the quality of the relationship prior to disease onset [17]. Studies utilizing this measure found that FTD caregivers had higher burden scores than caregivers of patients with AD and CBS [7, 15, 16].

The overall aim of this study is to determine which behavioral symptoms are associated with increased caregiver burden in FTD and CBS. To achieve this aim, we determined the relationship between the total FrSBe score and the subscales of the FrSBe (apathy, disinhibition and executive dysfunction) and FTD scores on the ZBI [7, 8].

Methods

Subjects

Patients with a diagnosis of FTD or CBS were referred to the Cognitive Neuroscience Section of the National Institute of Neurological Disorders and Stroke (NINDS) at the National Institutes of Health (NIH) and enrolled in a study to evaluate patients with FTD or CBS. All patients assigned durable power of attorney to their caregiver prior to enrollment, and assignees gave written informed consent for the study. The protocol and informed consent form were approved by the NINDS Institutional Review Board prior to the initiation of the study. They received extensive clinical and neuropsychological evaluations and underwent brain MRI and PET during a 1.5-week-long visit at the NIH. The diagnosis of FTD or CBS was confirmed according to published criteria and was reached through a consensus decision between a neurologist and a neuropsychologist based on the clinical history, the neurological examination and the results of neuroimaging and neuropsychological evaluations [11, 18–20]. There were 267 caregivers in total who had received the NPI, the ZBI and/or the FrSBe. Of those who completed any of these measures, there were 180 caregivers of patients diagnosed with FTD and 87 caregivers of patients diagnosed with CBS. Completed Family Rating Forms for FrSBe and ZBIs were collected for 102 of the 267 caregivers.

Behavioral Assessments

Frontal Systems Behavior Scale—The FrSBe is a 46-item questionnaire that evaluates neurobehavioral systems among those with frontal lobe damage [10, 12, 13, 21, 22]. The FrSBe is a scale that can discriminate between individuals with and without frontal lobe dysfunction [10, 12, 21, 22]. A T-score between 60 and 64 signifies that the patient has borderline frontal lobe dysfunction. A T-score greater than or equal to 65 indicates that the patient has frontal lobe dysfunction [13]. The scale includes three subscales: apathy (14 items), disinhibition (15 items) and executive dysfunction (17 items). Apathy scores can predict performance on activities of daily living [8, 12, 21–23]. Higher scores in disinhibition and executive dysfunction have been associated with caregiver burden in patients with different types of dementia such as FTD and AD [12, 16, 21, 23, 24]. Also, the subscale for disinhibition contains items that evaluate behaviors commonly observed in FTD such as impulsivity, labile emotionality and childlike behavior [21, 22]. For the subscales of apathy, disinhibition and executive dysfunction, a T-score cutoff score of 65 was used [23].

Zarit Burden Interview—The ZBI is a 22-item scale to assess the caregiver's physical, emotional, social and financial aspects in relation to caring for the elderly or disabled persons [12, 17, 25–27]. The ZBI rates each aspect in the following manner: each item is rated from 0 (never) to 4 (nearly always), and total scores range from 0 to 88 [12, 17, 25]. A total score below 20 indicates little or no burden. A total score between 21 and 40 indicates mild-to-moderate burden. A score between 41 and 60 indicates moderate-to-severe burden, and a score between 61 and 88 indicates severe burden [17, 25]. Also, a cutoff score of 24 indicates caregivers who may require intervention due to being at risk for high levels of stress and depression [7, 28].

Statistical Analysis

Analysis was done using SPSS software version 20.0 (SPSS, Chicago, Ill., USA) [29]. A multivariate logistic regression model was calculated using the total score from the ZBI, which will be referred to as caregiver burden, as the main outcome variable as well as the overall T-score for present state from the FrSBe as the main predictor variable, relationship to patient and diagnosis. The presence of caregiver burden was defined as being above the cutoff score of 24, and the presence of frontal lobe dysfunction was defined as being greater than or equal to a T-score of 65 [7, 13, 28].

Other independent predictors were T-scores from the apathy and disinhibition subscales of the FrSBe. These were examined separately from the overall T-score. The presence of apathy and disinhibition was defined as below the FrSBE cutoff T-score of 65. To measure the crude associations, a one-sample t test using the mean caregiver burden was assessed for the following groups: (1) caregivers of those with apathy and disinhibition, (2) caregivers of those with apathy only, (3) caregivers of those with disinhibition only and (4) caregivers of those without either apathy or disinhibition. A between-group two-sample t test was used to further examine mean caregiver burden stratified by type of diagnosis.

Diagnosis of FTD or CBS and relationship of caregiver to patient were considered as potential confounders of the association. The T-scores used from the FrSBe were already adjusted for gender, level of education and age.

Results

Diagnoses and Caregiver Burden

Out of 102 patients, 41 (40%) were diagnosed with CBS and 61 (60%) with FTD (table 1). Of the 61 patients diagnosed with FTD, patients were diagnosed with one of the three different subtypes; 52 (85%) were diagnosed with frontal variant, 8 (13%) with primary progressive aphasia and 1 (2%) with semantic dementia (table 1). Since there were not enough patients in each subtype and because they can have overlapping symptoms, the analysis did not consider FTD subtype and only used patients with overall diagnoses of FTD and CBS. The information regarding caregiver burden is given in table 1. The mean total score from ZBI was 34.4 (± 14.1). The total score for caregivers of CBS patients ranged from 2 to 57, with a mean score of 26.1 (± 11.3). The total score for caregivers of FTD patients ranged from 13 to 77, with a mean score of 39.9 (± 13.2).

Frontal Lobe Dysfunction

The mean overall T-score for frontal lobe dysfunction was 128.6 (± 37.9), 100 (± 28.1) for CBS patients and 147 (± 31.1) for FTD patients. A logistic regression on caregiver burden by a variable marking the cutoff between frontal lobe dysfunction and no frontal lobe dysfunction was performed on the overall sample (table 2). Caregivers of patients with frontal lobe dysfunction had 13.0 times the odds of having caregiver burden than caregivers of patients without frontal lobe dysfunction (95% CI: 4.0, 42.3). When controlling for type of diagnosis, caregivers of patients with frontal lobe dysfunction had 8.2 times the odds of having caregiver burden than caregivers of patients without frontal lobe dysfunction (95%

CI: 2.4, 28.8). When controlling for relationship to patient, the caregivers of patients with frontal lobe dysfunction had 16.4 times the odds of having caregiver burden (95% CI: 4.7, 57.3). After adjusting the model for relationship to patient and type of diagnosis, caregivers of patients with frontal lobe dysfunction had 10 times the odds of having caregiver burden (95% CI: 2.7, 36.9). All reported odds ratios (ORs) were statistically significant (table 2).

Apathy and Disinhibition

Logistic regression was used to evaluate the association between apathy and caregiver burden as well as the association between disinhibition and caregiver burden. Apathy was measured as the T-score after disease onset for the apathy subscale from the FrSBe (table 2). Caregivers of patients with apathy had 12.4 times the odds of having caregiver burden than caregivers of patients without apathy (95% CI: 4.0, 38.1). Disinhibition was measured by the T-score after disease onset for the disinhibition subscale from the FrSBe (table 2). Caregivers of patients with disinhibition had 11.3 times the odds of having caregiver burden than caregivers of patients without disinhibition (95% CI: 3.8, 33.8).

Since the apathy and disinhibition subscales help formulate the overall score, a model with these three predictors was not formed. Instead, an interaction between apathy and disinhibition was used to see if these two predictors depended on effects of each other. Interaction between apathy and disinhibition was evaluated by using logistic regression. The addition of the interaction between apathy and disinhibition to the model consisting of caregiver burden as the outcome of interest and apathy and disinhibition as predictors of interest was not statistically significant ($p = 0.9603$). The interaction term was not included in the model.

Overall, 57 patients met the cutoff scores for both apathy and disinhibition, 25 met the cutoff score only for apathy, 2 met the cutoff score only for disinhibition, and 18 patients did not meet the cutoff score for either apathy or disinhibition (table 3). The 2 patients with disinhibition only were excluded from the analysis, since this sample would have been considered underpowered (table 3). Additionally, this finding implies that disinhibition can only very rarely be present without apathy.

Since the models were statistically significant after adjusting for type of diagnosis and relationship to caregiver, a two-sample t test was done to assess the differences between FTD and CBS patients in terms of apathy and disinhibition. When the overall sample was divided by disease status, apathy and disinhibition seemed to be more present in the FTD patient group than in the CBS group. There were 46 FTD patients and 11 CBS patients with apathy and disinhibition, 13 CBS patients and 12 FTD patients with apathy only and 15 CBS patients and 3 FTD patients without apathy and disinhibition. The 2 patients with disinhibition only were diagnosed with CBS. There were no FTD patients with only disinhibition.

Executive Dysfunction

The majority had a T-score greater than 65 for the subscale of executive dysfunction during the date of the visit to the NIH. This meant that executive dysfunction was absent in the overall sample as a covariate. The sample was homogeneous in this regard.

Caregiver Burden as a Binary Outcome Variable and Subscales

Logistic regression was used to evaluate type of diagnosis in the association between apathy and caregiver burden as well as the association between disinhibition and caregiver burden (table 2). Caregivers of patients with apathy had 6.8 times the odds of having caregiver burden than caregivers of patients without apathy, adjusting for diagnosis of either FTD or CBS (95% CI: 2.0, 23.0). Caregivers of patients with disinhibition had 7.2 times the odds of having caregiver burden than caregivers of patients without disinhibition, adjusting for diagnosis (95% CI: 2.3, 22.9).

Relationship to patient was considered as a potential confounder, since it could be affected by frontal lobe dysfunction, the main predictor of interest, and caregiver burden, the outcome of interest (table 2). The same holds true for the association between disinhibition and caregiver burden (OR = 15.0; 95% CI: 4.3, 52.2) as well as the association between apathy and caregiver burden (OR = 12.9; 95% CI: 4.0, 41.5). All models were still statistically significant after adjusting for type of diagnosis and caregiver's relationship to patient (table 2).

To assess which type of behavioral symptom contributed the most to caregiver burden, the T-scores for current state of apathy and disinhibition were used. One-sample t tests for mean total ZBI score compared patients with apathy and disinhibition, apathy only, and no apathy and disinhibition (table 3). For those with apathy and disinhibition, the mean ZBI total score was 39.3 (95% CI: 36.0, 42.7). For those with only apathy, the mean ZBI total score was 34.0 (95% CI: 28.3, 39.6), and for those without apathy and disinhibition, the mean ZBI total score was 20.1 (95% CI: 15.1, 25.0). The greatest mean ZBI total score was related to patients exhibiting apathy and disinhibition. The least mean ZBI total score was related to patients without apathy and disinhibition (table 3).

A two-sample t test for total ZBI score compared FTD patients with CBS patients in terms of apathy and disinhibition, apathy only, and no apathy and disinhibition (table 3). There was more than a 4-fold difference in the number of FTD patients compared to CBS patients in terms of having apathy and disinhibition. The mean ZBI total score for FTD patients who expressed both apathy and disinhibition was 41.0 (95% CI: 37.3, 44.7), whereas the mean ZBI total score for CBS patients was 32.4 (95% CI: 25.7, 39.0). For apathy only, the mean ZBI total score for FTD patients was 39.4 (95% CI: 30.5, 48.3) compared to that of CBS patients (29; 95% CI: 21.9, 36.1). There were roughly equal numbers of FTD and CBS patients who expressed only apathy. There was a 5-fold difference in the number of FTD patients compared to CBS patients in terms of no expression of apathy or disinhibition. This group of patients also had the lowest mean scores. In each group, the caregivers of FTD patients reported higher scores of burden compared to the caregivers of CBS patients. The mean ZBI scores increased when apathy was noted in the patients.

Discussion and Conclusions

To the authors' knowledge, this is the first study to utilize a measure of behavioral symptoms associated with frontal lobe dysfunction and the ZBI for caregiver burden in these patient populations. The measures used in this study were reliable, valid measures that have

been used in studies evaluating other neurodegenerative disorders, especially AD [10, 13, 21, 22, 30]. In general, the Family Rating Form of the FrSBe is recommended for use in dementia patients, since anosognosia, abulia and amnesia can reduce the accuracy of the self-report form of the FrSBe [21, 22]. However, a limitation of the FrSBe is that it is narrow in scope. Compulsions, hyperphagia and insensitivity are not measured in the FrSBe, whereas these symptoms are measured in the NPI.

There was a statistically significant association between the total FrSBe score and caregiver burden after adjusting for diagnosis and relationship to patient. To further elucidate what the components of frontal lobe dysfunction were, FrSBe subscales of apathy and disinhibition were analyzed. Patients with both apathy and disinhibition had the highest mean total ZBI score. In addition, those with apathy and disinhibition were mostly likely to be diagnosed with FTD. This is consistent with prior studies which show FTD patients generally exhibit more apathy and disinhibition than CBS patients [10, 12, 13, 21]. Those without apathy and disinhibition were more likely to be diagnosed with CBS in the study sample. Apathy seemed to be the main contributor to caregiver burden, as reported in table 3.

An unexpected result was that apathy and disinhibition can co-occur, and apathy can occur without disinhibition, but isolated disinhibition without apathy is very rare in FTD and CBS. This argues against the idea that apathy and disinhibition are opposing, and mutually exclusive, ends of a spectrum of behavioral symptoms associated with frontal lobe dysfunction. Rather, this finding suggests that apathy is a very common symptom associated with frontal lobe dysfunction which is in many cases accompanied by disinhibition.

The overall findings from this study agree with the literature that frontal lobe dysfunction is associated with caregiver burden. Caregivers of patients with FTD are more likely to experience caregiver burden than caregivers of patients with CBS. When using the subscales of the FrSBe to evaluate caregiver burden, both apathy and disinhibition led to caregiver burden. Caregivers of FTD patients who expressed apathy and disinhibition were more likely to have distress than caregivers of CBS patients. This is a congruent finding, since apathy and disinhibition are common problems in FTD [9, 21, 31].

Caregivers, especially spouses, expressed negative feelings about the future and the incapability of coping. They may vent their frustrations and anger on supportive relationships, thus increasing their isolation and negativity [31, 32]. Psychotherapeutic interventions such as support groups and group therapy may reduce caregiver burden. Evidence is pending for the role of support groups and group therapy for dementia caregivers, but these interventions have been shown to reduce distress in patients with medical illnesses such as cancer [33]. The younger age of FTD caregivers compared to AD caregivers raises special issues that should be investigated, including the burden of raising young children while caring for a parent with FTD. More interventions designed to reduce caregiver distress are also needed [26, 32].

Acknowledgments

The authors wish to thank the staff at the Cognitive Neuroscience Section at the NINDS for data collection and study design.

References

1. Kasuya RT, Folgar-Bailey P, Takeuchi R. Caregiver burden and burnout. A guide for primary care physicians. *Postgrad Med.* 2000; 108:119–123. [PubMed: 11126138]
2. de Vugt ME, Riedijk SR, Aalten P, Tibben A, van Swieten JC, Verhey FR. Impact of behavioural problems on spousal caregivers: a comparison between Alzheimer's disease and frontotemporal dementia. *Dement Geriatr Cogn Disord.* 2006; 22:35–41. [PubMed: 16679763]
3. Katon W, Kleinman A, Rosen G. Depression and somatization: a review. *Am J Med.* 1982; 72:127–135. [PubMed: 7058818]
4. Schulz R, Beach S. Caregiving as a risk factor for mortality: the Caregiver Health Effects Study. *JAMA.* 1999; 282:2215–2219. [PubMed: 10605972]
5. Levy M, Miller B, Cummings J, Fairbanks L, Craig A. Alzheimer disease and frontotemporal dementias: behavioral distinctions. *Arch Neurol.* 1996; 53:687–690. [PubMed: 8929178]
6. Mioshi E, Bristow M, Cook R, Hodges JR. Factors underlying caregiver stress in frontotemporal dementia and Alzheimer's disease. *Dement Geriatr Cogn Disord.* 2009; 27:76–81. [PubMed: 19155621]
7. Knutson KM, Zamboni G, Tierney MC, Grafman J. Neural correlates of caregiver burden in cortical basal syndrome and frontotemporal dementia. *Dement Geriatr Cogn Disord.* 2008; 26:467–474. [PubMed: 18984957]
8. Zamboni G, Grafman J, Krueger F, Knutson KM, Huey ED. Anosognosia for behavioral disturbances in fronto-temporal dementia and corticobasal syndrome: a voxel-based morphometry study. *Dement Geriatr Cogn Disord.* 2010; 29:88–96. [PubMed: 20150729]
9. Mourik JC, Rosso SM, Niermeijer MF, Duivenvoorden HJ, van Swieten JC, Tibben A. Frontotemporal dementia: behavioral symptoms and caregiver distress. *Dement Geriatr Cogn Disord.* 2004; 18:299–306. [PubMed: 15305107]
10. Reid-Arndt SA, Schopp L, Brenneke L, Johnstone B, Poole AD. The Frontal Systems Behavior Scale (FrSBe) as a predictor of community integration following brain injury. *Brain Inj.* 2007; 21:1361–1369. [PubMed: 18066938]
11. Boeve, BF. Corticobasal degeneration: the syndrome and the disease. In: Litvan, I., editor. *Atypical Parkinsonian Disorders: Clinical and Research Aspects.* Totowa: Humana Press; 2005. p. 309–334.
12. Davis JD, Tremont G. Impact of frontal systems behavioral functioning in dementia on caregiver burden. *J Neuropsychiatry Clin Neurosci.* 2007; 19:43–49. [PubMed: 17308226]
13. Chio A, Vignola A, Mastro E, Dei Giudici A, Iazzolino B, Calvo C, Moglia C, Montuschi A. Neurobehavioral symptoms in ALS are negatively related to caregivers' burden and quality of life. *Eur J Neurol.* 2010; 17:1298–1303. [PubMed: 20402747]
14. Riedijk SR, de Vugt ME, Duivenvoorden HJ, Niermeijer MF, van Swieten JC, Verhey FR, Tibben A. Caregiver burden, health-related quality of life and coping in dementia caregivers: a comparison of frontotemporal dementia and Alzheimer's disease. *Dement Geriatr Cogn Disord.* 2006; 22:405–412. [PubMed: 16966830]
15. de Vugt ME, Nicolson NA, Aalten P, Lousberg R, Jolle J, Verhey FR. Behavioral problems in dementia patients and salivary cortisol patterns in caregivers. *J Neuropsychiatry Clin Neurosci.* 2005; 17:201–207. [PubMed: 15939974]
16. Rymer S, Salloway S, Norton LE, Malloy P, Correia S, Monast D. Impaired awareness, behavior disturbance, and caregiver burden in Alzheimer disease. *Alzheimer Dis Assoc Disord.* 2002; 16:248–253. [PubMed: 12468899]
17. Zarit SH, Reever KE, Bach-Peterson J. Relatives of the impaired elderly: correlates of feelings of burden. *Gerontologist.* 1980; 20:649–655. [PubMed: 7203086]
18. McKhann GM, Albert MS, Grossman M, Miller B, Dickson D, Trojanowski JQ. Clinical and pathological diagnosis of frontotemporal dementia: report of the Work Group of Frontotemporal Dementia and Pick's Disease. *Arch Neurol.* 2001; 58:1803–1809. [PubMed: 11708987]
19. Neary D, Snowden JS, Gustafson L, Passant U, Stuss D, Black S, Freedman M, Kertesz A, Robert PH, Albert MS, Boone K, Miller B, Cummings J, Benson DF. Frontotemporal lobar degeneration: a consensus on clinical diagnostic criteria. *Neurology.* 1998; 51:1546–1554. [PubMed: 9855500]

20. Rascovsky K, Hodges JR, Knopman D, Mendez MF, Kramer JH, Neuhaus J, van Swieten JC, Seelaar H, Dopper EG, Onyike CU, Hillis AE, Josephs KA, Boeve BF, Kertesz A, Seeley WW, Rankin KP, Johnson JK, Gorno-Tempini ML, Rosen H, Prioleau-Latham CE, Lee A, Kipps CM, Lillo P, Piguet O, Rohrer JD, Rossor MN, Warren JD, Fox NC, Galasko D, Salmon DP, Black SE, Mesulam M, Weintraub S, Dickerson BC, Diehl-Schmid J, Pasquier F, Deramecourt V, Lebert F, Pijnenburg Y, Chow TW, Manes F, Grafman J, Cappa SF, Freedman M, Grossman M, Miller BL. Sensitivity of revised diagnostic criteria for the behavioural variant of frontotemporal dementia. *Brain*. 2011; 134:2456–2477. [PubMed: 21810890]
21. Malloy P, Tremont G, Grace J, Frakey L. The Frontal Systems Behavior Scale discriminates frontotemporal dementia from Alzheimer's disease. *Alzheimers Dement*. 2007; 3:200–203. [PubMed: 19595938]
22. Grace J, Malloy P. Frontal Systems Behavior Scale (FrSBe): Professional Manual. Lutz, Psychological Assessment Resources. 2001
23. Mioshi E, Kipps CM, Hodges JR. Activities of daily living in behavioral variant frontotemporal dementia: differences in caregiver and performance-based assessments. *Alzheimer Dis Assoc Disord*. 2009; 23:70–76. [PubMed: 19266701]
24. Norton LE, Malloy P, Salloway S. The impact of behavioral symptoms on activities of daily living in patients with dementia. *Am J Geriatr Psychiatry*. 2001; 9:41–48. [PubMed: 11156751]
25. Boutoleau-Bretonniere C, Vercelletto M, Volteau C, Renou P, Lamy E. Zarit Burden Inventory and activities of daily living in the behavioral variant of frontotemporal dementia. *Dement Geriatr Cogn Disord*. 2008; 25:272–277. [PubMed: 18285675]
26. Coen RF, O'Boyle CA, Coakley D, Lawlor BA. Individual quality of life factors distinguishing low-burden and high-burden caregivers of dementia patients. *Dement Geriatr Cogn Disord*. 2002; 13:164–170. [PubMed: 11893838]
27. Bruce JM, McQuiggan M, Williams V, Westervelt H, Tremont G. Burden among spousal and child caregivers of patients with mild cognitive impairment. *Dement Geriatr Cogn Disord*. 2008; 25:385–390. [PubMed: 18376128]
28. Schreiner AS, Morimoto T, Aria Y, Zarit SH. Assessing family caregiver's mental health using a statistically derived cut-off score for the Zarit Burden Interview. *Aging Ment Health*. 2006; 10:107–111. [PubMed: 16517485]
29. SPSS Base 20.0 for Windows: User's Guide. Chicago: SPSS Inc; 2011.
30. Gonzalez EW, Polansky M, Lippa CF, Walker D, Feng D. Family caregivers at risk: who are they? *Issues Ment Health Nurs*. 2011; 32:528–536. [PubMed: 21767255]
31. Piguet O, Hornberger M, Mioshi E, Hodges JR. Behavioural-variant frontotemporal dementia: diagnosis, clinical staging, and management. *Lancet Neurol*. 2011; 10:162–172. [PubMed: 21147039]
32. Riedijk S, Duivenvoorden H, Rosso S, Van Swieten J, Niermeijer M, Tibben A. Frontotemporal dementia: change of familial caregiver burden and partner relation in a Dutch cohort of 63 patients. *Dement Geriatr Cogn Disord*. 2008; 26:398–406. [PubMed: 18936543]
33. Classen C, Butler LD, Koopman C, Miller E, DiMiceli S, Giese-Davis J, Fobair P, Carlson RW, Kraemer HC, Spiegel D. Supportive-expressive group therapy and distress in patients with metastatic breast cancer: a randomized clinical intervention trial. *Arch Gen Psychiatry*. 2001; 58:494–501. [PubMed: 11343530]

Table 1

Subject demographics

	Diagnosis of patient		
	FTD (n = 61; 60%)	CBS (n = 41; 40%)	Total (n = 102; 100%)
Caregiver burden			
No burden	4 (4%)	13 (13%)	17 (17%)
Mild	29 (28%)	22 (22%)	51 (50%)
Moderate	25 (25%)	6 (6%)	31 (30%)
Severe	3 (3%)	0 (0%)	3 (3%)
Frontal lobar dysfunction			
Present	57 (56%)	27 (26%)	84 (82%)
Absent	4 (4%)	14 (14%)	18 (18%)
Apathy			
Present	58 (57%)	24 (23%)	82 (80%)
Absent	3 (3%)	17 (17%)	20 (20%)
Disinhibition			
Present	46 (42%)	13 (13%)	59 (58%)
Absent	15 (15%)	28 (27%)	43 (42%)
Sex of patient			
Male	30 (29%)	21 (21%)	51 (50%)
Female	31 (30%)	20 (20%)	51 (50%)
Race of patient			
White/Caucasian	60 (59%)	37 (36%)	97 (95%)
African Americans	0 (0%)	2 (2%)	2 (2%)
Asian or Pacific Islanders	0 (0%)	2 (2%)	2 (2%)
Other	1 (1%)	0 (0%)	1 (1%)
Ethnicity of patient			
Hispanic	2 (2%)	0 (0%)	2 (2%)
Non-Hispanic	59 (58%)	41 (40%)	100 (98%)
Caregiver relationship to patient			
Significant other	53 (52%)	34 (33%)	87 (85%)
Family member	8 (8%)	5 (5%)	13 (13%)
Friend	0 (0%)	1 (1%)	1 (1%)
Paid caregiver	0 (0%)	1 (1%)	1 (1%)
Age of patient, years	60 ± 9	66 ± 8	63 ± 9

Table 2

Logistic regression model to predict caregiver burden

Main predictors for outcome of interest, caregiver burden	OR	95% CI	Wald χ^2 test	p value
Frontal lobe dysfunction (yes, no)	13.00	3.99 42.30	18.14	<0.0001
Apathy (yes, no)	12.38	4.02 38.14	19.22	<0.0001
Disinhibition (yes, no)	11.31	3.79 33.79	18.89	<0.0001
By diagnosis				
Frontal lobe dysfunction, adjusting for diagnosis	8.23	2.35 28.81	10.88	0.0010
Apathy, adjusting for diagnosis	6.82	2.03 22.97	9.61	0.0019
Disinhibition, adjusting for diagnosis	7.21	2.28 22.85	11.27	0.0008
By relationship to patient				
Frontal lobe dysfunction, adjusting for relationship to patient	16.45	4.72 57.34	19.31	<0.0001
Apathy, adjusting for relationship to patient	12.87	4.00 41.49	18.31	<0.0001
Disinhibition, adjusting for relationship to patient	14.99	4.31 52.17	18.10	<0.0001
By all confounding variables in each model				
Frontal lobe dysfunction, adjusting for diagnosis and relationship to patient	9.98	2.70 36.86	11.90	0.0006
Apathy, adjusting for diagnosis and relationship to patient	6.87	1.95 24.25	8.98	0.0027
Disinhibition, adjusting for diagnosis and relationship to patient	9.80	2.66 36.13	11.77	0.0006

Table 3

Effect of apathy and disinhibition on mean caregiver burden score using one-sample and two-sample t tests

Groups from subscales	Mean	95% CI	SD	95% CI
Apathy and disinhibition (n = 57)	39.33	36.01 42.66	12.52	10.57 15.36
FTD (n = 46)	41.00	37.26 44.74	12.59	10.44 15.86
CBS (n = 11)	32.36	25.72 39.01	9.89	6.91 17.36
Apathy only (n = 25)	34.00	28.35 39.65	13.68	10.68 19.03
FTLD (n = 12)	39.42	30.52 48.31	14.00	9.92 23.76
CBS (n = 13)	29.00	21.89 36.11	11.76	8.43 19.42
No (n = 18)	20.06	15.08 25.03	10.00	7.50 14.99
FTD (n = 3)	24.33	-11.52 60.19	14.43	7.52 90.71
CBS (n = 15)	19.20	14.04 24.36	9.32	6.82 14.70