



Published in final edited form as:

Am J Geriatr Psychiatry. 2016 May ; 24(5): 342–349. doi:10.1016/j.jagp.2015.10.009.

Executive Functioning in Participants Over Age of 50 with Hoarding Disorder

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Abstract

Objectives—The current investigation utilized mid-life and late-life participants diagnosed with hoarding disorder (HD) to explore the relationship between executive functioning and hoarding severity.

Design—Correlational analyses were used to investigate the associations between executive functioning and hoarding severity in nondemented participants. Multiple regression was used to determine if executive functioning had a unique association with HD severity when accounting for depressive symptoms.

Setting—Participants were recruited from the San Diego area for HD intervention studies.

Participants—Participants were 113 nondemented adults aged 50–86 years who met DSM-5 criteria for HD. The mean age of the sample utilized in the analyses was 63.76 years (SD, 7.2; range, 51–85 years). The sample was mostly female (72%), Caucasian (81.4%), and unmarried (78%).

Measurements—Hoarding severity was assessed using the Saving Inventory-Revised and the Clutter Image Rating and depression was assessed using the Hospital Anxiety and Depression Scale. Executive functioning was assessed using the Wisconsin Card Sorting Test (WCST-128) and the Trail Making and Verbal Fluency subtests of the Delis-Kaplan Executive Function System.

Results—Executive function (operationalized as perseveration on the WCST-128) was significantly associated with Clutter Image Ratings. In a multivariate context, executive function

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CONFLICT OF INTEREST

The authors declare no conflicts of interest. This research, and salary support for Dr. Ayers, was supported by a Career Development Award (CSR-068-10S) from the Clinical Science R & D Program of the Veterans Health Administration. The contents do not reflect the views of the Department of Veterans Affairs or the United States Government.

The authors have no disclosures to report.

and depressive symptom severity were both significant predictors of variance in Clutter Image Rating.

Conclusions—Our results suggest that executive function is related to severity of HD symptoms and should be considered as part of the conceptualization of HD.

Keywords

compulsive hoarding; Wisconsin card sorting test; OCD; Anxiety

INTRODUCTION

Executive functioning problems are often cited as a contributory factor in the maintenance of hoarding disorder (HD) symptoms.^{1–4} There is conflicting evidence, however, whether executive dysfunction exists in nondemented HD patients.⁵ Although many studies report either executive functioning deficits in HD or significant differences between HD individuals and comparison groups in several aspects of executive functioning,^{4,6–8} results have been inconsistent² and not always replicated.^{7–9} Woodey and colleagues⁵ point to the lack of control for factors such as age and depressive symptomatology in many of the investigations, as well as discrepancies in outcome variables as limitations on the ability to draw conclusions about executive functioning in HD patients. Furthermore, some previous investigations did not use standardized performance-based or traditional neuropsychological tests, which further limits the generalizability of their findings because the results are less easily compared. The present investigation sought to address gaps in the literature by examining the relationship between hoarding severity and executive function in a group of nondemented HD patients utilizing multiple standardized measures of executive functioning. Given that cognitive functioning decreases with age, even in healthy older adults,¹⁰ it is necessary to examine the association between hoarding and cognitive impairment across the life span.

Most previous investigations of executive functioning in HD have focused on nonelderly samples. Problems with decision-making,^{4,9,11,12} categorization,^{8,13,14} inhibition,^{4,7,14} cognitive flexibility,¹⁴ utilization of feedback,¹⁴ planning,^{8,13,15} and organization^{8,13,15} have been found in mid-life patients with HD. When individuals are asked to discard or make choices about their possessions, problems with decision-making, categorization, and organization may be more prominent than when they are asked to sort non-personal items.^{8,11–13}

Only two studies to date have investigated cognitive functioning in geriatric hoarding samples. When compared with nonpsychiatric older adults, late-life hoarding patients have been found to have increased problems with categorization,³ problem-solving,³ inhibition,⁶ and cognitive flexibility.⁶ Depressive symptoms alone do not account for executive functioning problems in older adults with hoarding problems.^{3,6} One investigation found that geriatric participants with major depression and hoarding behaviors had greater categorization and problem-solving impairment compared with non-hoarding older adults with depression.³ A second late-life study excluded all HD participants with comorbid axis I disorders, including major depression, and still found that geriatric HD participants had

increased levels of executive functioning problems when compared with healthy older adults.⁶

Although these results are intriguing, discrepancies in the literature persist. For example, on the Wisconsin Card Sorting Test (WCST^{16,17}), geriatric HD participants without comorbid axis I disorders performed worse than did nonpsychiatric comparison participants on multiple aspects of executive functioning, including reasoning/abstraction/concept formation and set shifting.⁶ Furthermore, hoarding symptom severity was strongly correlated with poor performance on the WCST in the HD group. These results were supported by the work of McMillan and colleagues,¹⁴ who found that HD patients had problems with perseveration and poor concept formation when compared with test norms on the WCST. Using a sample of middle-aged individuals, Tolin and colleagues² failed to find significant differences on the WCST between HD, obsessive-compulsive disorder (OCD), and healthy comparison participants, however. This lack of replication on the same test in HD patients also exists on the Iowa Gambling Test,¹⁸ another measure of decision-making-based executive functioning.^{7,9}

Clarification and further exploration of the relationship between executive functioning and hoarding severity in individuals with HD will elucidate the degree to which executive performance may contribute to functional impairment and affect treatment outcomes. The manifestation of executive dysfunction in HD patients may lead to a range of everyday functioning problems. For instance, difficulty in shifting strategies, problem-solving, and thinking flexibly may not only affect how HD patients make choices about their possessions, but may also impair the ability of HD patients to manage daily routines. Furthermore, executive dysfunction in areas of abstraction, switching, and cognitive flexibility may limit response to cognitive behavioral therapy (CBT) for HD, particularly in older adulthood.^{6,19,20} Deficits in abstraction, switching, and cognitive flexibility could limit the ability of a patient to follow the “rules” of CBT or exposure treatment, which would ultimately decrease the effectiveness of the intervention. Individuals with lower levels of abstraction, switching, and cognitive flexibility may be less able to create and maintain organizational systems, which could result increased clutter and hoarding symptoms over time.

The primary hypothesis of the current investigation was that increased impairment in executive functioning—operationalized through assessments of abstraction, switching, and cognitive flexibility—would be associated with increased hoarding severity in nondemented HD participants. The secondary hypothesis of the study was that the executive functioning components examined would have unique associations with HD severity when accounting for depressive symptoms.

METHODS

Participants

Participants were 113 nondemented adults aged 51–85 years who met DSM-5 criteria for HD. Participants were recruited from the San Diego area between July 2008 and April 2014 for either of two individual intervention studies for late-life HD (N = 70) or for a group

intervention study for HD that recruited participants from across the lifespan (N = 43). All participants met DSM-5 criteria for HD as determined by a consensus diagnosis discussed during weekly supervision between a master's level assessor and a licensed clinical psychologist. The diagnosis was based on an hour-long assessment of hoarding symptoms that included a clinician-administered semi-structured interview (the UCLA Hoarding Severity Scale²¹) and scores on two self-report measures, the Clutter Image Rating (CIR²²) and the Saving Inventory-Revised (SI-R²³). The assessor also conducted an unstructured interview to determine final DSM-5 diagnostic criteria, including the requirement that the hoarding symptoms not be due to a comorbid medical or psychiatric diagnosis, including OCD.

Individuals (N = 28) who scored less than 26 (cutoff for dementia) on the Montreal Cognitive Assessment (MoCA²⁴) were excluded. Other exclusion criteria included active substance use disorders, psychotic disorders, and bipolar I or II disorder. Participants were on stable doses of any psychiatric medications, with no changes for at least 3 months prior to the assessment.

All study protocols were approved by the institutional review board of the University of California, San Diego, and by the VA San Diego Healthcare System. No monetary compensation was provided for participation, and all participants provided written informed consent. Only the data from participants' baseline assessments were utilized in the current investigation. All participants performed above cutoff for neuropsychological performance validity (=15 on the forced choice condition of the California Verbal Learning Test-Second Edition²⁵).

Measures

Hoarding Severity—Hoarding severity was assessed using the CIR and the SI-R. The SI-R is a 23-item self-assessment measure of hoarding symptoms, including difficulty discarding, urges to save, and impairment due to clutter volume in the home. Participants are asked to rate the intensity of their experience related to a series of questions about their hoarding symptoms. Scores over 40 on the SI-R are indicative of clinically severe hoarding symptoms. The current study found adequate internal reliability ($\alpha = 0.90$).

The CIR is a three-item pictorial assessment of clutter volume. Participants are presented with three sets of nine pictures (one set each for the living room, bedroom, and kitchen) and are instructed to "Please select the photo below that most accurately reflects the amount of clutter in your room" for each room. The three items are averaged to create a mean score, ranging from 1 to 9 with higher scores indicating higher clutter levels. Participant ratings on the CIR have been found to closely correspond to clinician ratings in both middle-aged adults^{22,26,27} and older adults,²⁸ indicating that the CIR may be a more objective assessment of hoarding severity than other self-report measures. The current study found adequate internal reliability of the items ($\alpha = 0.88$).

Cognition—The Word Reading subtest of the Wide Range Achievement Test, Fourth Edition (WRAT-4 Reading²⁹) was used as a measure of pre-morbid IQ and the MoCA²⁴ was administered as a measure of current global cognitive functioning. Executive functioning

was measured by 1) raw scores for Total Errors and Perseverative Errors from the computerized version of the WCST-128,¹⁷ a test of problem-solving and cognitive flexibility; 2) raw scores for Category Switching (total correct) from the Verbal Fluency subtest of the Delis-Kaplan Executive Function System (D-KEFS³⁰), a test of cognitive flexibility; and 3) raw scores (completion time) for the D-KEFS Trails Number-Letter Switching test, an additional test of cognitive flexibility.

Mood—Depressive symptoms were assessed using the Depression scale of the Hospital Anxiety and Depression Scale (HADS³¹), a 14-item self-report measure of mental health. Scores of 0 to 7 on the HADS Depression subscale indicate no clinically severe mental health symptoms; scores of 8 to 10 indicate borderline severity; and scores of 11 or higher indicate clinically severe symptoms. The current study found adequate internal reliability of the HADS Depression subscale ($\alpha = 0.82$).

Data Analysis

For sample characterization purposes, the percentage of participants with mildly impaired or worse performance scores on the executive function (EF) variables, defined as scores outside of 1 standard deviation,³² was calculated using a cutoff of less than 40 for T-scores on the WCST-128 (demographically corrected for age and education) and less than 7 for scaled scores on the D-KEFS (demographically corrected for age). The primary hypothesis of the current study—that increased impairment in executive functioning is associated with worse hoarding severity—was examined with correlations to examine the relationships between HD severity and cognition. Because we were interested in the relationship between performance and symptom severity, we elected to not use normed scores that correct for demographic variables. Instead, we used raw scores first, then examined the influence of age by including it as a covariate.

A multiple linear regression analysis was used to examine the second hypothesis, that EF has a unique association with HD severity when accounting for individual differences in the HADS Depression subscale, academic achievement, and demographic factors. The WRAT-4 Reading Raw Score was used to control for differences academic achievement in order to have a more standardized assessment of ability than years of education. Race was not controlled for in the multiple linear regression analysis because the majority of our sample was Caucasian. Because of concerns of multicollinearity in the EF variables, only the EF variable most strongly associated with HD severity in the correlation analyses (WCST Perseverative Errors) was used in the multiple regression analysis. All analyses were performed using Stata version 13.0.³³

RESULTS

The mean age of the sample was 63.8 years (SD: 7.2; range: 51–85 years). The sample was mostly female (72%), Caucasian (81%), and unmarried (78%). Participants reported an average of 15.7 years of education (SD: 2.1; range: 10–21 years) and 49% of participants were retired. Descriptive statistics are presented in Table 1, including the percentage of participants who performed in the mildly impaired or worse performance range on each EF variable. The average EF scores and frequency of mildly impaired or worse performance on

EF variables were within normal limits. Over 17% of participants' scores on the WCST-128 Total Errors and over 9% of participants' scores on the WCST-128 Perseverative Errors were consistent with mildly impaired or worse performance using age- and education-corrected T-scores. Over 6% of participants' scores on the D-KEFS Trail Making Test Number-Letter Switching and nearly 12% of participants' scores on the D-KEFS Trail Making Test Number-Letter Switching were in the mildly impaired or worse performance range using age-corrected scaled scores.

As seen in Table 2, hoarding severity based on both the SI-R and CIR was not correlated with overall cognition based on the MoCA total score or premorbid IQ based on the WRAT-4 Reading raw score. Although the SI-R was not associated with any of the executive function measures, the CIR was significantly associated with raw scores on WCST-128 Total Errors and Perseverative Errors, such that individuals with higher clutter levels made more Total Errors and Perseverative Errors on the WCST-128. The CIR was not associated with the switching raw scores of the D-KEFS Trails or Verbal Fluency tests. Both the CIR and SI-R measures were significantly correlated with the HADS Depression subscale.

In order to examine whether executive functioning is associated with hoarding severity when accounting for individual differences in depression, a multiple regression analysis was conducted using the most highly predictive executive functioning (WCST-128 Perseverative Errors raw score) and HD (CIR) variables identified in the correlational analysis and controlling for the HADS Depression scale, the WRAT-4 Word Reading raw score, and demographic characteristics. A model containing WCST-128 Perseverative Errors raw score, the HADS Depression scale, the WRAT-4 Word Reading raw score, age, and sex significantly predicted scores on the CIR, explaining 13% of the variance (see Table 3). The WCST-128 Perseverative Errors raw score significantly predicted HD symptom severity in the multivariate model (see Table 3).

CONCLUSIONS

This examination of executive functioning included the largest sample of formally diagnosed mid-life and late-life HD participants to date. Findings support the bulk of the literature suggesting an association between executive function and HD severity, even when controlling for age, sex, academic achievement, and depression. We found significant relationships between the hoarding symptom severity and executive function (WCST-128 Total Errors and Perseverative Errors), with Perseverative Errors showing the strongest relationship. Thus, HD patients with worse cognitive flexibility have more severe hoarding symptoms. HD patients may have difficulty responding to corrective feedback by switching set, a pattern that may be consistent with real-world problems with adapting behavior to feedback from others.

Interestingly, executive functioning was not associated with hoarding severity as measured by the SI-R, which was, instead, most highly associated with depressive symptom severity. Statements on the SI-R are potentially emotionally laden and may evoke negative responding mediated by depression (e.g., *To what extent do you feel unable to control the clutter in your home? Or How distressing do you find the task of throwing things away?*).

Thus, items on the SI-R may confound clutter and the person's level of distress. Furthermore, the SI-R solicits thoughts about one's own hoarding symptoms, which requires insight and ability to accurately self-judge. In contrast, the CIR is a more objective measure of clutter and may be less affected by distress or depression, as evidenced in our regression analysis. The use of this pictorial scale for assessing proportional clutter volume potentially eliminates the issue of under- or over-reporting clutter based on false associations with the word.²² Visual depictions of clutter levels may allow the respondent to more accurately rate the severity of their own clutter and may be a better indicator of functionality within the home.

Our results are largely consistent with previous investigations examining the WCST in HD populations. McMillan and colleagues¹⁴ found significant differences between mid-life hoarding participants and age-matched healthy comparison participants on WCST perseverative errors. Lawrence and colleagues⁹ also reported significant differences between OCD participants (including some with hoarding symptoms) and normal comparison participants on multiple WCST scores, including Perseverative Errors—although in that study the participants did not meet criteria for hoarding disorder, only hoarding in the context of OCD. Interestingly, our group did not show significant differences between healthy comparison subjects and HD patients on Perseverative Errors but did show differences on other WCST scores including Total Errors, Non-Perseverative Errors, and Conceptual Level Responses⁶ This previous investigation did not assess performance validity, however, which may have affected the findings. The Total Errors subtest may have been driven by the Non-Perseverative Errors, which is less executive functioning based.

Given that Tolin and colleagues² examined only the WCST Total Errors and SI-R, our findings are not directly in contrast to their results. It is possible, given our larger HD sample size ($N = 113$), utilization of the CIR, examination of within group relationships, and exploration of other WCST subtests, that we found significant results. As previously stated, the SIR may be measuring distress rather than actual clutter severity.

For mental health providers who treat patients with HD, these results may not be surprising because of the strong clinical evidence of executive functioning deficits in people with HD. Difficulty responding to environmental feedback is reflected in the real world by the way HD patients continue to behave in unproductive ways even when provided with feedback about their actions. For example, clinicians often see people with HD making futile attempts, often for years, to remove their clutter (e.g., buying more containers, setting high self-expectations for clearing rooms). Furthermore, an inability to shift strategies and think flexibly influences the choices that HD patients make not only about their possessions, but also in other areas of their lives. This is potentially evidenced by problems with functional impairment, which have been well documented in geriatric HD samples.³⁴ Clinicians should be aware of functional problems at every level, not just related to hoarding symptoms. For instance, even getting to a treatment session could be difficult—patients with HD have problems organizing themselves to get to appointments on time (knowing when they need to start to shower, eat for breakfast, drive time, items to bring, etc.). Finally, our results also support the idea that distress is distinct from function in HD and therefore measures to assess HD should be selected accordingly.

This study has several strengths, including strict inclusion and exclusion criteria, a relatively large sample size, use of validated measures of hoarding severity, and standardized neuropsychological tests. Depression, age, and premorbid IQ were well controlled. There are limitations to the study, however, including a lack of comparison group and multiple comparisons. Additional investigation is needed regarding alternative treatments for HD that incorporate skills training to ameliorate the effects of executive functioning problems on daily functioning and traditional CBT approaches. Future studies should also investigate the degree to which executive functioning may play a moderating role in hoarding treatment efficacy and whether compensatory cognitive training, as is sometimes used to treat HD,³⁵ may lead to a decrease in problems related to executive function. This study adds to the growing body of literature that suggests that executive functioning contributes to the expression of HD symptom severity and should be part of the conceptualization of HD.

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TABLE 1

Sample characteristics (N = 113)

	Raw Scores			Standardized Scores		
	Mean	SD	Range	Mean	SD	Range
SL-R Total	58.10	12.16	20–89	—	—	—
CIR	4.13	1.79	1–9	—	—	—
HADS Depression Subscale	7.84	4.10	1–21	—	—	—
MoCA Total Score	26.54	2.04	21–30	—	—	—
WRAT-4 Word Reading	64.27	5.19	45–70	111.07	15.85	74–145
WCST-128 Total Errors	30.55	21.54	8–95	49.04	9.43	26–80
WCST-128 Perseverative Errors	15.12	11.92	4–63	50.56	7.85	31–80
D-KEFS Trail Making Test Number-Letter Switching	98.72	39.83	43–240	10.85	2.68	2–15
D-KEFS Verbal Fluency Test Category Switching Total Correct	13.50	3.47	0–24	11.21	3.78	1–19

Notes: CIR: Clutter Image Rating; D-KEFS: Delis-Kaplan Executive Function System (standardized scores are based on age-matched scaled scores); HADS: Hospital Anxiety and Depression Scale; MoCA: Montreal Cognitive Assessment; SL-R: Saving Inventory-Revised; WCST-128: Wisconsin Card Sorting Test (standardized scores are based on age- and education-matched T-scores); WRAT-4: Wide Range Achievement Test, Fourth Edition.

^aMildly impaired or worse performance was defined as t scores <40 or scaled score <7.

TABLE 2

Correlations among study variables (N = 113)

	CIR	p	SI-R Total	p
SI-R Total	0.481	<0.0001	—	—
WRAT-4 Word Reading	0.055	0.567	0.004	0.969
HADS Depression Subscale	0.223	0.020	0.493	<0.0001
MoCA Total Score	0.002	0.980	0.021	0.831
WCST-128 Total Errors	0.228	0.017	0.097	0.318
WCST-128 Perseverative Errors	0.240	0.012	0.076	0.434
D-KEFS Trail Making Test Number-Letter Switching	0.150	0.124	0.080	0.411
D-KEFS Verbal Fluency Test Category Switching Total Correct	-0.092	0.341	0.124	0.200

Notes: CIR: Clutter Image Rating; D-KEFS: Delis-Kaplan Executive Function System (Raw Scores); HADS: Hospital Anxiety and Depression Scale; MoCA: Montreal Cognitive Assessment; SI-R: Saving Inventory-Revised; WCST-128: Wisconsin Card Sorting Test (Raw Scores); WRAT-4: Wide Range Achievement Test, Fourth Edition (Raw Scores).

TABLE 3

Multivariate Prediction of Hoarding Severity on the CIR (N = 106)

Measures	F ^a	R ²	B (S.E.)	β	t ^b	p
Overall Model	2.96	0.129				0.016
WCST-128 Perseverative Errors			0.04 (0.02)	0.27	2.62	0.010
HADS Depression subscale			0.11 (0.04)	0.25	2.68	0.009
WRAT-4 Word Reading			0.03 (0.03)	0.10	0.99	0.324
Age			0.0004 (0.02)	0.001	0.02	0.986
Sex			-0.02 (0.37)	0.005	-0.05	0.961

Notes: CIR: Clutter Image Rating; HADS: Hospital Anxiety and Depression Scale; WCST-128: Wisconsin Card Sorting Test; WRAT-4: Wide Range Achievement Test, Fourth Edition.

^adf: 5, 100.

^bdf: 100.