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Cognitive Change Checklist (3CL): Psychometric Characteristics in Community Dwelling Older Adults

John A. Schinka, Ph.D.^{1,2}, Diane C. Robinson, Ph.D.³, Whitney L. Mills, Ph.D.^{4,5}, and Lisa M. Brown, Ph.D.⁶

¹James A Haley VA Medical Center, Tampa, FL ²Department of Psychiatry, University of South Florida, Tampa ³Department of Psychology, University of Central Florida, Orlando ⁴Health Services Research & Development Center of Excellence, Michael E. DeBakey VA Medical Center, Houston, TX ⁵Department of Medicine, Baylor College of Medicine, Houston, TX ⁶School of Aging Studies, University of South Florida, Tampa

Abstract

Objective—To extend the psychometric study of the Cognitive Change Checklist (3CL) by examining the reliability, factor structure, and external correlates of 3CL informant and self-report ratings in community dwelling adults. We also conducted ROC analyses examining rating scores from this normative sample with those of clinical samples.

Design—Scale reliability and validity study.

Setting—Community sites.

Participants—Six hundred and seventy-nine older adults.

Results—The pattern of scale relationships within and across versions, and the failure to find associations with age and education, were consistent with findings in clinic samples reported previously. Factor analysis replicated the four-factor structure of the informant ratings. All informant version scales significantly discriminated amnesic Mild Cognitive Impairment (MCI) cases and patients with mild dementia from normals.

Conclusion—These findings provide support for the use of the checklist as a clinical tool to facilitate identification of cases of MCI and early dementia.

Keywords

rating scales; informant; activities of daily living; cognition; aging; cognitive decline; mild cognitive impairment; dementia

OBJECTIVE

There is ample evidence to support an informant-based approach in screening and diagnostic efforts (1–3), but existing instruments are not maximally designed to capture recent changes

Correspondence: John A. Schinka, Ph.D. 10770 North 46th Street, C100 Tampa, FL 33617 (813) 610-2388 jschinka@health.usf.edu.

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in cognitive status of the types seen in Mild Cognitive Impairment (MCI)(5–6). Schinka et al. (6–7) recently developed the Cognitive Change Checklist (3CL), a 28-item checklist of cognitive change that is composed of four non-overlapping scales providing informant and self-report ratings of episodic memory, executive function, language, and remote recall as well as a total checklist score.

In the original Schinka et al. study (6), 3CL informant scale reliabilities (alpha coefficients $> .85$) were found to be well within psychometric guidelines to support use in clinical assessment. Validity of the 3CL was supported by 1) analyses showing large and significant correlations with neurocognitive performance measures, 2) significant differences in informant scale scores among diagnostic groups (patients with dementia, MCI, normals with cognitive complaints) that paralleled those of the neurocognitive measures, and 3) ROC analyses that revealed AUCs equivalent to those of the MMSE. In all analyses, 3CL informant ratings had superior psychometric characteristics in comparison to self-report ratings. In a second study, Schinka et al. (7) found additional support for the reliability and factor structure of 3CL informant scales in a heterogeneous clinical sample. Additionally, ROC analyses provided extended evidence for the discriminative ability of 3CL informant scales to identify cases of MCI and dementia.

In this study, we aimed to extend the psychometric study of the 3CL by examining the reliability, factor structure, and external correlates of 3CL informant and self-report ratings in a large sample of community dwelling adults. We also conducted ROC analyses examining rating scores from this normative sample with those of the clinical samples previously described by Schinka et al. (7). These analyses were conducted to provide a more comprehensive foundation for determining the potential value of the 3CL in clinical settings.

METHODS

Participants and Procedures

This study was approved by an Institutional Review Board, and all participants provided informed consent. Data were provided by a sample of 679 individuals age 55 and older who were individually recruited from community agencies and organizations. No individuals meeting the age requirement were excluded from participation. Consenting individuals completed a packet containing a brief questionnaire capturing self-report demographics, health history, and a 44-item self-report research version of the 3CL alone or a similar packet that also requested demographic information and informant version ratings from a spouse or relative with whom they lived. These versions contained all items in the 3CL originally studied by Schinka et al. as well as four validity items designed to capture complaints of unlikely problems in everyday cognition (e.g., difficulty remembering birthdate or city of birth).

Data Analyses

Only the 28 3CL final version items from the study by Schinka et al. (6) were analyzed. Internal consistency reliability (alpha) coefficients were calculated to determine the reliability of 3CL informant and self-report scales. Scale validities were examined by calculating correlations with demographic characteristics and a global health index calculated as the number of endorsements for 24 common health conditions (e.g., hypertension, diabetes). We examined checklist structure by conducting a principal components analysis of the informant version items. Because of concerns about using confirmatory factor analysis to examine models of factor structure (8), we used an alternative method of examining the factor structure for validation purposes, following a procedure described by Gorsuch (9). We conducted a principal components analysis that

extracted four factors and then calculated the coefficient of congruence (range of possible values is -1.00 to $+1.00$) for each factor with those revealed in the development of the 3CL. To achieve a large coefficient, this procedure requires that the full pattern of all 28 item loadings are similar in both studies. Finally, we examined the discriminability of each of the 3CL scales by examining scores from this community sample and scores from clinical samples in a previous study by Schinka et al. (7). We used standard conventions for interpreting significant AUC values: $.60-.69$ = poor; $.70-.79$ = fair; $.80-.89$ = excellent.

RESULTS

Participants were primarily White (90.0%), female (56.6%), married (72.3%) non-Hispanics (95.3%); mean age was 69.3 ± 7.6 years and mean years of education was 14.6 ± 2.9 . The sample was composed of 249 individuals with both self-report and informant ratings, 77 individuals with informant ratings only, and 353 individuals with self-report ratings only. When cases with outlying scale score values or missing data were excluded from relevant analyses, intact data were available for informant ratings of 304 individuals, for self-report ratings for 565 individuals, and for combined ratings for 227 individuals.

Reliability, Scale Intercorrelations, and Version Differences

Table 1 provides alpha coefficients and intercorrelations for all scales. Alpha coefficients for the total and Memory scales for both versions exceed $.80$. Values for the other scales for both versions range from $.71$ to $.79$. Values in this range are expected because the average interitem correlation for scales designed to measure clinical phenomena are usually attenuated in normative samples in comparison to patient samples. These values are sufficient, however, to support research and clinical use of the checklist in normal samples. Intercorrelations for all 3CL self-report and informant scales and intraclass coefficients for same scale correlations across versions are lower in absolute value than is typically seen in clinical samples, but again this is likely due to the relatively restricted variance of scale scores. As can be seen in Table 1, the correlation for any scale is higher with other scales within the same version than it is with the same scale in the other version. This pattern is consistent with that found in 3CL clinical samples and supports the common finding of low levels of association between self-report and informant ratings in a variety of samples. Comparisons of version scale scores revealed higher scores for the informant version for all 3CL scales. Paired t-tests revealed that these differences were significant for all but the Memory and Executive scales (Memory $t = -.752$, $df = 226$, $P > .05$; Executive $t = 1.507$, $df = 226$, $P > .05$; Language $t = 5.386$, $df = 226$, $P < .001$; Remote Recall $t = 3.655$, $df = 226$, $P < .001$; total score $t = 2.405$, $df = 226$, $P < .05$).

Factor Structure

The four factors produced by the principal components analysis with orthogonal (Varimax) rotation were found to have item loadings that were highly correlated with those reported by Schinka et al. (6) in the initial development of the 3CL. For the four factors, the coefficients of congruence were: Memory, $.96$; Executive, $.95$; Language, $.95$; and Remote Recall, $.96$. All 28 items had their highest loadings on the expected factor, providing strong support for the four-factor structure and for placement of items on each of the scales.

Influence of Demographic and Health Variables

Correlations of age, years of education, and the health index with 3CL informant and self-report ratings are presented in Table 1. All correlations achieved small values ($r \leq .20$). Several coefficients were significant; however, none achieved the criterion for more than a small effect size ($.10 < r < .30$). Because age, education, and sex are variables commonly used in the adjustment of normative tables for clinical purposes, we conducted hierarchical

linear regression analyses using these variables as predictors of 3CL scale scores. Because education is known to moderate the impact of age on cognition, we also included an age-by-education interaction term. For both versions, the full regression models were significant and explained .7 – 3.7% of the variance in 3CL scale scores ($M = 2.5\%$ for informant scales; $M = 1.9\%$ for self-report scales). However, examination of individual contributions of age, years, and sex to variance in 3CL scale scores revealed that none contributed significantly to informant version scale scores. The contributions to self-report ratings of these variables were inconsistent across scales and small even when significant ($< 1\%$ of explained variance). In no case was there more than a single demographic variable that contributed to variance in self-report scores. The age-by-education interaction term was never a significant contributor to ratings for either version of the 3CL.

ROC Analyses

We merged the 3CL data for this normative sample with clinical samples (approximately 25 cases per diagnostic group) reported in a previous Schinka et al. study and conducted ROC analyses to determine the discriminative ability of the scales. Three clinical groups were used: amnesic MCI, non-amnesic MCI, and mild dementia (mean MMSE = 24) cases. As can be seen in Table 1, the self-report 3CL scales did not identify either amnesic or non-amnesic MCI cases (AUCs $\leq .600$), but did have fair ability to discriminate demented cases (AUCs = .70 to .78). In contrast, all informant version scales significantly discriminated amnesic MCI and demented cases from normals. The Memory and total scale scores had excellent ability (AUCs $\geq .80$) to identify amnesic MCI cases. All informant version scales had excellent ability to identify cases of mild dementia. However, the AUCs for informant scales were all below .60.

CONCLUSIONS

Our examination of 3CL scales in a large sample of community cases provides support for the reliability and stable factor structure of the informant version of the checklist. The pattern of relationships within and across versions, and the failure to find associations with age and education, are consistent with the findings in clinic samples reported previously and support the use of 3CL informant ratings across age and education groups. Replication of the factor structure of the 3CL indicates that the construct of cognitive change is reflected in the four specific facets of cognition measured by the 3CL. ROC analyses, unadjusted for age and education, revealed that the informant 3CL scales have good potential to serve as screening instruments to identify cognitive change due to pathologies producing amnesic MCI, but not to pathologies underlying other less common forms of MCI. These analyses provide further support for the use of the 3CL informant scales. In clinical settings, 3CL informant ratings could be especially valuable in screening programs and in initial cognitive evaluations aimed at early identification of degenerative dementias. In research applications, 3CL informant ratings would provide a measure of early or accelerating cognitive decline in aging populations, as well as an exclusion measure in studies aimed at examining cognitively normal elderly. We do note that the sample size for this study was reasonably large, but it was not very diverse. Future studies should explore 3CL psychometric characteristics in samples marked by racial and ethnic heterogeneity. Additionally, the discriminative and diagnostic characteristics of the 3CL informant scales should be examined in studies with larger diagnostic samples that include specific subtypes of MCI.

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Table 1
Correlations for 3CL informant and self-report versions and AUC discrimination values for informant scales

Scale	Validity measure correlations			Alpha	Scale Intercorrelations										AUCs for Normals vs		
	Age	Yrs of Educ	Health Index		2	3	4	5	6	7	8	9	10	MCI-A	MCI-nonA	Mild Dementia	
Informant Version (n = 304)																	
1	Full-scale	.06	-.13*	.18*	.90	.91	.86	.81	.74	.38	.37	.28	.22	.21	.80±.06†	.57±.08	.84±.07†
2	Memory	.12	-.08	.20*	.83		.67	.64	.57	.33	.36	.23	.18	.24	.82±.06†	.57±.09	.80±.07†
3	Executive	-.04	-.09	.05	.75			.65	.56	.28	.28	.25	.17	.13	.76±.06†	.54±.08	.87±.06†
4	Language	.03	-.14*	.14*	.79				.46	.34	.19	.23	.16	.17	.73±.07†	.56±.08	.81±.06†
5	Remote Recall	.01	-.15*	.13*	.73					.23	.19	.23	.16	.17	.66±.08*	.55±.08	.82±.07†
Self-report Version (n = 565)																	
6	Full-scale	.15*	-.03	.16*	.91						.92	.84	.79	.60	.59±.06	.57±.06	.78±.07†
7	Memory	.15*	-.03	.14*	.83							.65	.60	.45	.56±.06	.58±.06	.74±.08†
8	Executive	.11	-.01	.10*	.71								.65	.40	.59±.07	.55±.06	.78±.07†
9	Language	.11	.00	.15*	.78									.33	.60±.07	.54±.06	.73±.06†
10	Remote Recall	.13*	-.10	.15*	.74										.54±.06	.55±.06	.70±.07†

Note. MCI-A = amnesic MCI; MCI-nonA = nonamnesic MCI. Coefficients in italics are intraclass correlations (df1 = 226, df2 = 226); all others are Pearson coefficients. For correlations of informant version scales with validity measures, df = 297; for correlations of self-report version scales with validity measures, df = 553. For intercorrelations among informant version scales, df = 295; for intercorrelations among self-report version scales, df = 553; for correlations between informant version and self-report scales, df = 225.

* $P < .05$,

[†] $P < .01$