Published in final edited form as:
*Neuropsychol Rehabil*. 2010 October ; 20(5): 725–738. doi:10.1080/09602011003765690.

# Functional cooking skills and neuropsychological functioning in patients with stroke: An ecological validity study

**Christine L. Yantz, PhD**,
Department of Physical Medicine and Rehabilitation-Division of Rehabilitation Psychology and Neuropsychology; The Johns Hopkins University School of Medicine, Baltimore, MD

**Doug Johnson-Greene, PhD**,
Department of Rehabilitation Medicine; University of Miami-Leonard M. Miller School of Medicine, Miami, FL

**Christopher Higginson, PhD**, and
Department of Psychology; Loyola College in Maryland, Baltimore, MD

**Lindsay Emmerson, PhD**
VA San Diego Healthcare System, San Diego, CA

## Abstract

Efforts to relate neuropsychological performance to real-world task functioning have predominantly yielded lackluster results, typically with neuropsychological performance accounting for modest amounts of variance in function. Nonetheless, the ecological validity of neuropsychological measures for predicting functional abilities remains a strong research interest and clinical necessity. This study relates neuropsychological performance to performance on a standardized cooking task (Rabideau Kitchen Evaluation-Revised; RKE-R) in persons with stroke. Results showed that while the composite score of mean neuropsychological performance had the largest association with meal preparation, several neuropsychological measures were significantly related to the RKE-R. Groups of left and right hemisphere stroke patients were not significantly different in terms of RKE-R performance. These results suggest that functional cooking task performance is related to intact cognitive abilities in delayed verbal memory, simple auditory attention, and visuospatial skills, as well as overall cognitive performance. Implications for neuropsychologists are discussed.

### Keywords

Ecological validity; predictive validity; neuropsychological assessment; cerebrovascular accidents; activities of daily living; cooking

Historically, neuropsychological tests were largely used to establish diagnosis, but in recent years there has been a growing interest in understanding how neuropsychological test performance relates to everyday functioning (Ruff, 2003). For example, neuropsychologists are sometimes called upon to make inferences about their patient's ability to complete instrumental activities of daily living (IADLs) such as driving, shopping, and preparing meals. This use of neuropsychological testing is based on the assumption of a relationship between cognition and functional activities, and the need for an efficient way to estimate whether problems can be anticipated on in-vivo functional tasks based on cognitive abilities.

The generalizability of traditional neuropsychological tests to these real-world behaviors, sometimes referred to as ecological validity, has become a point of increased scientific interest (Chaytor & Schmitter-Edgecombe, 2003). The vast majority of this research has attempted to determine the predictive value of commonly used neuropsychological instruments on

functional outcomes that have significant impact on patients' independence or safety in the community. In neurologically-compromised patients, it has been shown that performance on neuropsychological measures can account for a moderate amount of variance in global composite measures of functional outcome (Higginson, Arnett, & Voss, 2000), need for supervision (Hanks *et al.*, 2008), return to work (Kibby, Schmitter-Edgecombe, & Long, 1998), and completion of IADLs (Farias, Harrell, Neumann, & Houtz, 2003; Farmer & Eakman, 1995), including managing finances (Okonkwo, Wadley, Griffith, Ball, & Marson, 2006). In a review of the neuropsychological correlates of driving ability, Withaar, Brouwer, and van Zomeren (2000) concluded that cognitive impairments are associated with driving difficulties, but the predictive value of individual neuropsychological tests is very limited as the demands of novel paper-and-pencil tests and performing complex, but well-learned, driving tasks are fundamentally different.

In response to the apparent need to improve the ecological validity of neuropsychological measures several tests have been developed to more closely reflect everyday situations (i.e., to address verisimilitude), such as the Test of Everyday Attention (Robertson, Ward, Ridgeway, & Nimmo-Smith, 1994) and the Behavioral Assessment of the Dysexecutive Syndrome (Wilson, Alderman, Burgess, Emslie, & Evans, 1996); however, there has been limited movement towards adoption of these measures according to a recent survey of neuropsychologists (Rabin, Burton, & Barr, 2007), and the relationship between traditional neuropsychological measures and those designed to be more ecologically valid remains unclear.

It has been shown that after stroke, a common cause of long-term disability in the United States, a substantial number of people have difficulty with IADLs and that IADL performance. Additionally, IADL performance has been found to be moderately correlated with life satisfaction (Hartman-Maeir, Soroker, Ring, Avni, & Katz, 2007). Meal preparation is one IADL that is important for individuals' sense of life satisfaction (Johnston, Goverover, & Dijkers, 2005). To date, few studies have systematically assessed the relationship between cognitive impairments and their impact on functional cooking skills. While most IADL measures include cooking, these instruments typically involve self-report or non-standardized clinical assessments.

In a series of studies, closed head-injured patients and patients with resected frontal lobe tumors were shown to have difficulty with a functional task involving meal planning, shopping, and preparation as well as decreased neuropsychological performance on a task of complex processing speed (Fortin, Godbout, & Braun, 2003; Godbout, Grenier, Braun, & Gagnon, 2005).

In addition, Godbout et al. (2005) showed a significant correlation between meal planning/preparation and a composite measure of executive functioning. In a study examining the Rabideau Kitchen Evaluation-Revised (RKE-R; Neistadt, 1992, 1994), a standardized assessment of functional meal preparation skills in brain injured adults, the performance of adults with traumatic brain injury was significantly correlated with performance on WAIS-III Block Design (Neistadt, 1992). These studies suggest that cognitive abilities, particularly those involving executive functioning and visual-spatial ability, may be associated with a patient's meal preparation ability. Recently some studies have examined neuropsychological performance and systematic assessment of cooking ability in patients with stroke. One study examined performance on the four standardized functional tasks of the Executive Function Performance Test (EFPT), including cooking, in a sample of persons with stroke, finding significant moderate correlations between EFPT total score and neuropsychological performance of attention, working memory, and verbal fluency (Baum *et al.*, 2008). Katz et al. (2000) examined the effect of hemispatial neglect on both cognitive performance and meal

preparation in persons with right hemisphere stroke, using the RKE-R to assess meal preparation and the Loewenstein Occupational Therapy Cognitive Assessment to assess orientation, perception, visuomotor organization, and "thinking operations." They found moderate to high correlations ($r = -.77$ to $-.80$) between RKE-R performance and the visuomotor organization and thinking operations domains within the patients with neglect. These correlations were lower in the non-neglect group ($r = -.36$ to $-.60$).

In the current study we examined the relationship between performance on the RKE-R and neuropsychological tests in a sample of patients with stroke. Neuropsychological tests were selected from well-validated measures that are commonly used for neuropsychological screening. The RKE was used because it was one of the only standardized in-vivo cooking measures at the time of the data collection. Based on previous research of neuropsychological correlates of functional measures (Cahn-Weiner et al., 2007; Cahn-Weiner, Malloy, Boyle, Marran, & Salloway, 2000; Godbout et al., 2005; Kibby et al., 1998), we hypothesized that measures of executive functioning and verbal memory would be moderately related to cooking skills. However, based on Withaar et al.'s (2000) suggestion that the predictive value of individual neuropsychological tests is very limited, we also hypothesized that a neuropsychological composite score would be more strongly related to cooking skills than individual measures of distinct cognitive domains. This hypothesis is also consistent with recent findings specific to stroke populations (Man, Tam, & Hui-Chan, 2006).

## Method

### Participants

Twenty-one patients admitted for comprehensive inpatient rehabilitation within 3 weeks of stroke onset participated in this study. The current study was conducted with a sample of patients shortly after their stroke event based on the recent trend of brief inpatient rehabilitation stays; patients are typically returning home (where they may have to cook) within a week to ten days following a stroke. Acute CVA was verified by CT scan, neurological examination, or both. All participants were receiving rehabilitation services as part of their routine clinical care and had at least six years of education, spoke English as their primary language, had no severe auditory or visual impairments that significantly interfered with testing, had no evidence of multiple strokes, and denied any history of alcohol or drug abuse or premorbid neurological disease (e.g., dementia). Persons were excluded if they had a MMSE score below 16 or significant aphasia that would impact comprehension or expression during the neuropsychological tests. Aphasia was determined using a score of $\leq 2$ on the Aphasia Severity Rating Scale (ASRS) of the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1983). These relatively strict exclusion criteria were utilized to reduce the possibility that sensory or nervous system dysfunction unrelated to acute stroke influenced performance on any of the measures. Data from one participant were excluded because her extremely impaired performance on the RKE-R, which appeared to be related to poor effort, made her a statistical outlier. This resulted in a total sample size of 20 participants for subsequent analysis.

Eleven of the patients were male. Seventeen of the patients were Caucasian, two were African-American, and one was Hispanic. All 20 participants included in the analyses were right-hand dominant. Eighty-five percent (n = 17) of the patient sample had experienced an ischemic stroke. Six patients had documented left hemisphere stroke, 13 patients had right hemisphere stroke, and one patient had a cerebellar stroke. This patient group, heterogeneous with respect to stroke severity and laterality, is typical of patients admitted to an inpatient rehabilitation setting. Patient characteristics can be found in Table 1.

## Procedures

Patients were administered a group of psychometrically validated cognitive tests chosen for their brevity and their widespread use in clinical settings. The MMSE (Folstein, Folstein, & McHugh, 1975), Stroke Inpatient Depression Inventory (Rybarczyk, Winemiller, Lazarus, Haut, & Hartman, 1996), and the NIH Stroke Rating Scale (Brott et al., 1989) as part of a comprehensive neuropsychological evaluation. Neuropsychological measures administered included a measure of attention, the Brief Test of Attention (BTA; Schretlen, 1997), a Letter Cancellation Test (Mesulam, 1985), a measure of executive function, the Cognitive Estimation Test (CET; Axelrod & Millis, 1994), a measure of learning and memory, the Hopkins Verbal Learning Test-Revised (HVLT-R; Brandt & Benedict, 2001), a measure of language, the Boston Naming Test-30 item version derived from the original experimental version (BNT; Kaplan, Goodglass, & Weintraub, 1976), and a measure of visuospatial skill, the Rey Complex Figure Test – Copy (RCFT; Meyers & Meyers, 1995).

In addition to the cognitive tests, we administered the RKE-R, which has been shown to have good inter-rater and test-retest reliability. The test requires the completion of two tasks, preparation of a sandwich and a hot beverage, which are rated according to the number of cues or direct instructions needed by the patient to complete the 40 subcomponent tasks. Steps to prepare the beverage include selecting the appropriate container, safely using a hot stove, and pouring and stirring the drink. Preparing the sandwich includes opening and closing containers of food, arranging food items, using a knife safely, and cleaning the food preparation area. For each component, scores range from 0 (completely independent) to 3 (unable to perform), for a total possible score of 120 for a patient unable to complete any steps and 0 for a patient who is able to complete the tasks independently.

Patients were assessed using the FIM (formerly known as the Functional Independence Measure; Uniform Data System for Medical Rehabilitation, 1997) upon admission to the comprehensive inpatient rehabilitation program and upon discharge from the hospital. The FIM is a measure of functional independence commonly used in rehabilitation settings, incorporating trained on-site rehabilitation professionals' ratings of motoric independence on 13 basic activities of daily living including toileting, grooming, bathing, and five ratings of cognitive abilities including problem solving and memory. Scores range from 18 to 126, with high scores indicating greater independence. Total FIM scores at admission and discharge were included in analyses as descriptive variables.

## Analyses

Due to positive skew in the distribution of RKE scores, nonparametric statistics were used in the analyses. To determine which neuropsychological measures are linearly associated with RKE-R performance, one-tailed bivariate Spearman rank-order correlations between the raw total scores for neuropsychological tests and RKE-R were performed, controlling for Type I error using Holm's Sequential Bonferroni correction. Correlations were also computed between demographic variables and RKE-R performance. A composite neuropsychological score was calculated using the mean z-score of the neuropsychological tests that were correlated with the RKE that are representative of different cognitive domains. Using this strategy, the z-scores of four tests (BTA, CET, RCFT, and HVLT-R Recall) were averaged as the composite score. Patients' raw scores were transformed to z-scores using data from a sample of 327 neurologically normal adults as reported in Schretlen, Testa, Winicki, Pearlson, and Gordon (2008). This normative information was preferentially selected by the investigators over those available for each test's initial standardization sample because it would eliminate any potential statistical difficulties associated with differences between the standardization samples. Though normative data that allow for demographic adjustments are commonly used, there has been some evidence that this practice may not be accurate when classifying a patient's

functional status (Silverberg & Millis, 2009). As above, the one-tailed bivariate Spearman rank-order correlation between these four neuropsychological measures and the composite indicator of neuropsychological test performance and RKE-R was calculated. Finally, an independent-samples *t*-test was computed to determine if stroke laterality contributed to RKE-R performance.

## Results

Correlations of the RKE-R with demographic and neuropsychological measures can be found in Table 1. None of the demographic variables, aside from the FIM score at discharge, were significantly correlated with performance on the RKE-R. No significant group differences in RKE-R performance were found for stroke laterality ($t$ = .570; p = .58).

A significant association was found between RKE-R performance and nearly all cognitive tests (i.e., MMSE, BTA, HVLT-R Delayed Recall, and RCFT), with the HVLT-R Delayed Recall score producing the strongest association ($\rho = -.78$; Table 1). While all but two (CET and BNT) of the neuropsychological measures were significantly correlated with RKE performance using the modified Bonferroni correction (Table 2), the Spearman correlation for the composite neuropsychological score was as robust as the HVLT-R Delayed Recall score ($\rho = -.80$), and only modestly superior to the MMSE (p = −.73). A measure of visuospatial neglect (Cancellation Test Errors) was also not found to be significantly correlated with patients' meal preparation.

To further examine the relationship between neuropsychological test performance and meal preparation ability, a post-hoc series of group-wise analyses were performed. A cut-score of >5 errors on the RKE-R was set, so that approximately half (n = 11) of the current sample would be considered to "pass" the RKE-R and half (n = 9) would be considered to "fail" the RKE-R. Then the mean neuropsychological scores of these two groups were compared in a series of *t tests* (Table 3). When examined as groups, persons with successful RKE-R performance had significantly better scores on the BTA, HVLT-R learning and delayed recall, RCFT copy, MMSE, and CET than persons who had more than 5 errors on the RKE-R.

## Discussion

The purpose of this study was to explore the relationship between neuropsychological measures and performance on a functional meal preparation task in a sample of persons with recent stroke. The goal of the study was not unlike the goals of typical neuropsychological evaluations in which neuropsychologists are asked to make predictions about a patient's real-world functional impairments. Few studies have examined the cognitive correlates of cooking skills despite the importance of this IADL. As a secondary goal of the study, we set out to determine if a composite neuropsychological summary score would be more strongly associated with functional performance on the RKE-R compared to individual measures reflecting different cognitive domains.

The results suggest that a broad range of neuropsychological measures are related to performance of a functional cooking task, which should not be surprising given the cognitively diverse nature of cooking. Strong relationships with RKE-R performance were found for a cognitive screening measure (the MMSE) as well as measures of attention, learning, memory, and visuospatial ability. The relationship between RKE and a neuropsychological composite score, and HVLT-R Delayed Memory, were found to be quite large, but on par with the RKE-R's association with a general screening measure, the MMSE. There was no significant relationship between confrontational naming, visuospatial neglect, or estimation abilities and RKE-R performance.

To further clarify the nature of neuropsychological performance in persons who are successful or unsuccessful at meal preparation, post-hoc groupwise analyses were performed. These analyses demonstrated that the group of patients who have more than 5 errors on the RKE-R had significantly worse performance on measures of several areas of cognitive functioning, including attention, learning and memory, visuospatial organization, cognitive estimation, and overall basic cognitive abilities. With this alternative method of examining cognitive performance as related to meal preparation, there again was no significant relationship between confrontational naming and visuospatial neglect, and this analysis showed no significant difference in recognition ability between the two groups.

Regarding the relationships between individual neuropsychological tests and the RKE-R, this study generally upholds previous findings. We hypothesized that RKE-R performance would be associated with memory functioning, which was supported by our results. The implication of this finding is that one must remember not only the verbal request to complete the task, but also the procedural components of a meal preparation task in this unfamiliar environment. Although we predicted that measures of executive functioning would be related to RKE-R scores, the lack of a strong relationship between the CET, specifically, and the functional task was not unexpected based on previous research showing that the CET does not have the significant predictive validity that traditional executive functioning measures do (Silverberg, Hanks, & McKay, 2007). Recent research suggests that the CET may not adequately measure executive functioning and has poor divergent validity, with moderate correlations with tests across a broad range of cognitive domains (Spencer & Johnson-Greene, 2009). We did not predict a significant relationship between RKE-R and visuospatial functioning, though this may have more relevance to a stroke population given the ubiquitous presence of visual field defects. Performance on the RCFT has also been partially linked to executive functioning abilities (Schwarz, Penna, & Novack, 2009; Watanabe *et al.*, 2005), which may explain why this test had a significant association with the RKE-R.

One surprising result was the lack of significant correlation between a measure of visuospatial neglect and cooking performance in this study despite highly significant relationships between performance on neuropsychological measures and the functional tasks. Based on the findings that persons with spatial neglect had significantly poorer functional abilities (including RKE-R performance) (Katz et al., 2000), it was expected that there would be a strong relationship between such variables in the current study. On examining the data, a strong correlation was found for the total time taken for the Cancellation Test and RKE-R performance ($\rho = .53$), despite the nonsignificant relationship between errors on the task and cooking. Though speed of performance can be due to neglect, primary processing speed difficulties also would impact this score and are commonly seen after stroke.

The composite cognitive impairment score was found to have a marginally stronger association with RKE-R performance, though it is important to note that the association was not statistically more robust that individual cognitive measures of memory, attention, and visuospatial skills. This finding reinforces the value of individual tests for predicting functional abilities and suggests that the predictive utility of neuropsychological testing is not substantially enhanced when using composite measures of cognitive performance. The reason for this may be that functional task performance, such as successful meal preparation, requires adequate skills across a variety of cognitive abilities, each of which contributes a relatively equal proportion to completion of the task. Accumulating information about a person's abilities or deficits across different cognitive domains can better address this than trying to use composite impairment scores. In fact, it is likely that significant impairment in any one cognitive domain may serve to impact functional task performance. It has been suggested that constructs that neuropsychological tests measure are not well-understood (Dodrill, 1997), which may

contribute to the rather modest correlations found between neuropsychological measures and functional tasks reported thus far.

### Limitations

The current study has several potential limitations. Our sample size is modest, though we appeared to have adequate power to detect the robust correlations between variables of interest examined in this study. Related to the small sample size, a detailed analysis of the effects of stroke laterality on meal preparation ability was out of the scope of this study. Though the current results showed that persons with left or right hemisphere strokes had similar RKE-R scores, it is likely that the potential cognitive deficits leading to meal preparation problems for each group would be different, therefore causing the correlations with the neuropsychological test scores to be different in the two groups. That is, they might come to the same final score on the RKE-R due to different cognitive strengths and weaknesses. While this could not be directly examined in the current study, the robustness of most of the correlations between the RKE-R and neuropsychological measures with the full sample of persons with stroke suggests that laterality of stroke may not have a large impact by itself.

Another limitation of this study, and also a challenge for neuropsychologists who work with an acute stroke population, is that the recency of the stroke (interquartile range of 4 to 10 days post-stroke) may impact global functional abilities in the earliest stages of patients' recovery. Despite this challenge, clinicians, both neuropsychologists and occupational therapists, are required to provide assistance with functional abilities and discharge recommendations at this early stage of recovery. Indeed, frequently persons with stroke return home within seven to ten days following their stroke events and may be confronted with tasks, such as meal preparation, during this early recovery stage. It is important to recognize that, regardless of stroke laterality, a patient's cognitive performance across a number of domains is related to his or her meal preparation ability. Follow-up research examining sub-acute patients who continue to have difficulty with preparation of food and drinks may be helpful to clarify whether specific neurologic injuries result in prolonged meal preparation difficulty.

Our conclusions about the potential for individual tests to predict meal preparation performance are limited by the representative test that was used for four cognitive domains. It is possible that using other unexamined measures, including alternate measures of executive functioning, may have even greater associations with meal preparation performance.

### Conclusion

The current findings suggest that the performance of a meal preparation task is strongly related to a variety of cognitive skills including delayed verbal memory, simple attention, and visuospatial skill. These relationships were also demonstrated when comparing neuropsychological performance between groups of persons successful or unsuccessful at meal preparation. Our finding of significant relationships between the RKE-R and other cognitive domains is consistent with the multifaceted nature of cooking. Based on the heterogeneous cognitive deficits associated with stroke, many of which have a propensity to affect functional task performance, the continued use of cognitive measures with an acute stroke population to detect cognitive abilities that may predict functional outcomes is encouraged.

## Acknowledgments

This research was supported by NIH grant AA013898. The authors would like to thank Laura McGinnis for her assistance with collecting the Rabideau Kitchen Examination-Revised (RKE-R) data for this project.

## References


Axelrod BN, Millis SR. Preliminary standardization of the cognitive estimation test. Assessment 1994;1:269–274.

Baum CM, Connor LT, Morrison T, Hahn M, Dromerick AW, Edwards DF. Reliability, validity, and clinical utility of the Executive Function Performance Test: a measure of executive function in a sample of people with stroke. American Journal of Occupational Therapy 2008;62:446–455. [PubMed: 18712007]

Brandt, J.; Benedict, RHB. Hopkins Verbal Learning Test-Revised: Professional Manual. Psychological Assessment Resources, Inc.; Lutz, FL: 2001.

Brott T, Adams HP, Olinger CP, Marler JR, Barsan WG, Biller J. Measurements of acute cerebral infarction: A clinical examination scale. Stroke 1989;20:864–870. [PubMed: 2749846]

Cahn-Weiner DA, Farias ST, Julian L, Harvey DJ, Kramer JH, Reed BR, et al. Cognitive and neuroimaging predictors of instrumental activities of daily living. Journal of the International Neuropsychological Society 2007;13:747–757. [PubMed: 17521485]

Cahn-Weiner DA, Malloy PF, Boyle PA, Marran M, Salloway S. Prediction of functional status from neuropsychological tests in community-dwelling elderly individuals. The Clinical Neuropsychologist 2000;14:187–195. [PubMed: 10916193]

Chaytor N, Schmitter-Edgecombe M. The ecological validity of neuropsychological tests: a review of the literature on everyday cognitive skills. Neuropsychology Review 2003;13:181–197. [PubMed: 15000225]

Dodrill CB. Myths of neuropsychology. The Clinical Neuropsychologist 1997;11:1–17.

Farias ST, Harrell E, Neumann C, Houtz A. The relationship between neuropsychological performance and daily functioning in individuals with Alzheimer's disease: ecological validity of neuropsychological tests. Archives of Clinical Neuropsychology 2003;18:655–672. [PubMed: 14591439]

Farmer JE, Eakman AM. The relationship between neuropsychological functioning and instrumental activities of daily living following acquired brain injury. Applied Neuropsychology 1995;2:107–115. [PubMed: 16318513]

Folstein MF, Folstein SE, McHugh PR. Mini-mental state. A practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research 1975;12:189–198.

Fortin S, Godbout L, Braun CM. Cognitive structure of executive deficits in frontally lesioned head trauma patients performing activities of daily living. Cortex 2003;39:273–291. [PubMed: 12784889]

Godbout L, Grenier MC, Braun CM, Gagnon S. Cognitive structure of executive deficits in patients with frontal lesions performing activities of daily living. Brain Injury 2005;19:337–348. [PubMed: 16094781]

Goodglass, H.; Kaplan, E. The assessment of aphasia and related disorders. 2nd ed. Lea & Fibiger; Philadelphia: 1983.

Hanks RA, Millis SR, Ricker JH, Giacino JT, Nakese-Richardson R, Frol AB, et al. The predictive validity of a brief inpatient neuropsychologic battery for persons with traumatic brain injury. Archives of Physical Medicine & Rehabilitation 2008;89:950–957. [PubMed: 18452745]

Hartman-Maeir A, Soroker N, Ring H, Avni N, Katz N. Activities, participation and satisfaction one-year post stroke. Disability and rehabilitation 2007;29:559–566. [PubMed: 17453976]

Higginson CI, Arnett PA, Voss WD. The ecological validity of clinical tests of memory and attention in multiple sclerosis. Archives of Clinical Neuropsychology 2000;15:185–204. [PubMed: 14590548]

Johnston MV, Goverover Y, Dijkers M. Community activities and individuals' satisfaction with them: Quality of life in the first year after traumatic brain injury. Archives of Physical Medicine & Rehabilitation 2005;86:735–745. [PubMed: 15827926]

Kaplan, E.; Goodglass, H.; Weintraub, S. Boston Naming Test. Experimental Edition. Aphasia Research Center, Boston University; Boston: 1976.

Katz N, Hartman-Maeir A, Ring H, Soroker N. Relationships of Cognitive Performance and Daily Function of Clients Following Right Hemisphere Stroke: Predictive and Ecological Validity of the LOTCA Battery. The Occupational Therapy Journal of Research 2000;20:3–17.

Kibby MY, Schmitter-Edgecombe M, Long CJ. Ecological validity of neuropsychological tests: focus on the California Verbal Learning Test and the Wisconsin Card Sorting Test. Archives of Clinical Neuropsychology 1998;13:523–534. [PubMed: 14590636]

Man DW, Tam SF, Hui-Chan C. Prediction of functional rehabilitation outcomes in clients with stroke. Brain Injury 2006;20:205–211. [PubMed: 16421069]

Mesulam, M-M. Principles of Behavioral Neurology. F. A. Davis; Philadelphia: 1985.

Meyers, J.; Meyers, K. The Meyers scoring system for the Rey Complex Figure and the recognition trial: Professional manual. Psychological Assessment Resources; Odessa, FL: 1995.

Neistadt ME. The Rabideau Kitchen Evaluation-Revised: An assessment of meal preparation skill. The Occupational Therapy Journal of Research 1992;12:242–253.

Neistadt ME. A meal preparation treatment protocol for adults with brain injury. American Journal of Occupational Therapy 1994;48:431–438. [PubMed: 8042686]

Okonkwo OC, Wadley VG, Griffith HR, Ball K, Marson DC. Cognitive correlates of financial abilities in mild cognitive impairment. Journal of the American Geriatrics Society 2006;54:1745–1750. [PubMed: 17087703]

Rabin LA, Burton LA, Barr WB. Utilization rates of ecologically oriented instruments among clinical neuropsychologists. The Clinical Neuropsychologist 2007;21:727–743. [PubMed: 17676540]

Robertson, IH.; Ward, T.; Ridgeway, V.; Nimmo-Smith, I. Test of everyday attention (TEA). Harcourt Assessment; London: 1994.

Ruff RM. A friendly critique of neuropsychology: facing the challenges of our future. Archives of Clinical Neuropsychology 2003;18:847–864. [PubMed: 14609580]

Rybarczyk B, Winemiller DR, Lazarus LW, Haut A, Hartman C. Validation of a depression screening measure for stroke inpatients. The American Journal of Geriatric Psychiatry 1996;4:131–139.

Schretlen, DJ. Brief test of attention: Professional manual. Psychological Assessment Resources; Odessa, FL: 1997.

Schretlen DJ, Testa SM, Winicki JM, Pearlson GD, Gordon B. Frequency and bases of abnormal performance by healthy adults on neuropsychological testing. Journal of the International Neuropsychological Society 2008;14:436–445. [PubMed: 18419842]

Schwarz L, Penna S, Novack T. Factors contributing to performance on the Rey Complex Figure Test in individuals with traumatic brain injury. The Clinical Neuropsychologist 2009;23:255–267. [PubMed: 19172529]

Silverberg ND, Hanks RA, McKay C. Cognitive estimation in traumatic brain injury. Journal of the International Neuropsychological Society 2007;13:898–902. [PubMed: 17697421]

Silverberg ND, Millis SR. Impairment versus deficiency in neuropsychological assessment: Implications for ecological validity. Journal of the International Neuropsychological Society 2009;15:94–102. [PubMed: 19128532]

Spencer RJ, Johnson-Greene D. The Cognitive Estimation Test (CET): Psychometric limitations in neurorehabilitation populations. Journal of Clinical and Experimental Neuropsychology 2009;31:373–377. [PubMed: 18649163]

Uniform Data System for Medical Rehabilitation. The guide for the uniform data set for medical rehabilitation (including the FIM instrument). Version 5.1 ed. UDSMR; Buffalo: 1997.

Watanabe K, Ogino T, Nakano K, Hattori J, Kado Y, Sanada S, et al. The Rey-Osterrieth Complex Figure as a measure of executive function in childhood. Brain Development 2005;27:564–569. [PubMed: 16310591]

Wilson, BA.; Alderman, N.; Burgess, PW.; Emslie, H.; Evans, JJ. Behavioral Assessment of the Dysexecutive Syndrome (BADS). Thames Valley Test Company; Bury St. Edmunds, UK: 1996.

Withaar FK, Brouwer WH, van Zomeren AH. Fitness to drive in older drivers with cognitive impairment. Journal of the International Neuropsychological Society 2000;6:480–490. [PubMed: 10902417]

## Table 1

Spearman correlations between the Rabideau Kitchen Evaluation-Revised (RKE-R) and demographic, clinical, and cognitive measures

| | Median (IQR) | Spearman Correlation |
|---|---|---|
| Demographics and Clinical Variables | | |
| Age (years) | 71.5 (59-77) | −.06 |
| Education (years) | 12 (10.5-16) | −.33 |
| Days since stroke | 6 (4-10) | −.17 |
| NIH Stroke Rating Scale score | 4.5 (2-6) | .08 |
| FIM at admission | 71 (64-78) | −.37 |
| FIM at discharge | 93.5 (87-100) | −.59 |
| Stroke Inpatient Depression Inventory score | 7 (3-12) | −.24 |
| Neuropsychological Measures | | |
| Screening | | |
| MMSE total | 25 (22-28) | −.73 |
| Attention and Executive functioning | | |
| Brief Test of Attention total | 7 (3-11) | −.66 |
| Cognitive Estimation Test | 12.5 (9-15) | .45 |
| Learning and Memory | | |
| HVLT-R Trials 1—3 | 18 (15-22) | −.66 |
| HVLT-R Delayed Recall | 6.5 (2-8) | −.78 |
| HVLT-R Recognition Discrimination | 8 (7-10) | −.65 |
| Language | | |
| BNT-30 item | 27 (21-29) | −.37 |
| Visuospatial Ability | | |
| Cancellation test errors | 4.0 (1-10) | .17 |
| RCFT copy | 25.5 (17-33) | −.67 |
| Neuropsychological summary z-score | −0.43 (−.97−.17) | −.80 |
| Functional Abilities | | |
| RKE-R total | 5 (1-16) | -- |

IQR = interquartile range

## Table 2

*Ranking of neuropsychological correlates by their* p*-values and their necessary significance values*

| Variable | *p*-value | required for significance |
|---|---|---|
| Neuropsychological summary z-score | <.001* | .005 |
| HVLT-R Delayed Recall | <.001* | .006 |
| MMSE total | <.001* | .006 |
| RCFT copy | .001* | .007 |
| Brief Test of Attention total | .001* | .008 |
| HVLT-R Trials 1—3 | .001* | .010 |
| HVLT-R Recognition Discrimination | .001* | .013 |
| Cognitive Estimation Test | .024 | .017 |
| BNT-30 item | .055 | .025 |
| Cancellation Test Errors | .170 | .050 |

* denotes a significant result after Holm-Sequential Bonferroni correction.

## Table 3

Secondary analysis of neuropsychological performance in persons successful or unsuccessful at meal preparation

| Variable | RKE-R pass Mean (*SD*) | RKE-R fail Mean (*SD*) | *t* score | *p*-value |
|---|---|---|---|---|
| MMSE total | 26.6 (2.3) | 22.4 (2.8) | 3.48 | .003* |
| Brief Test of Attention total | 11.2 (4.7) | 3.3 (2.7) | 4.67 | .000* |
| Cognitive Estimation Test | 10.0 (4.1) | 14.2 (2.7) | −2.77 | .013* |
| HVLT-R Trials 1-3 | 21.8 (5.4) | 15.1 (4.8) | 2.95 | .009* |
| HVLT-R Delayed Recall | 7.5 (2.3) | 2.8 (2.9) | 4.07 | .001* |
| HVLT-R Recognition | 9.0 (1.7) | 6.1 (3.1) | 2.47 | .030 |
| BNT-30 item | 26.8 (3.0) | 23. 4 (5.7) | 1.60 | .137 |
| Cancellation test errors | 4.7 (5.1) | 10.3 (12.0) | −1.31 | .218 |
| RCFT copy | 30.8 (4.3) | 19.1 (8.2) | 3.88 | .002* |

*Note*. Success in meal preparation was defined for this analysis as persons with 5 or fewer errors on the RKE-R.

* significant after Holm-Sequential Bonferroni correction.