*The Clinical Neuropsychologist*, 20: 637–648, 2006

ISSN: 1385-4046 print/1744-4144 online
DOI: 10.1080/13854040500477498

# IQ-BASED NORMS FOR HIGHLY INTELLIGENT ADULTS

**Dorene M. Rentz[1], Lisa M. Sardinha[1], Terri J. Huh[2], Meghan M. Searl[1], Kirk R. Daffner[1], and Reisa A. Sperling[1]**
[1]*Department of Neurology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA and* [2]*Department of Psychology, University of California San Francisco, San Francisco, CA, USA*

***This study presents normative data of commonly used neuropsychological tests administered to 75 individuals with high levels of intelligence (estimated IQ ≥ 120). Participants were living independently in the community with ages ranging from 44 to 86. To avoid including individuals with an incipient dementia, we selected subjects who scored within the normal range on all cognitive tests for at least a two-year period. The norms are presented in table format to help clinicians easily identify a typical cognitive performance in highly intelligent individuals and to provide a useful guide for detecting abnormal cognitive decline in individuals at risk for progressive dementia.***

## INTRODUCTION

The ability to differentiate a normal performance from abnormalities in cognitive function is central to all neuropsychological investigations. To do this, neuropsychologists rely on normative data that are valid and appropriate to the individual being assessed. The more precise the match between the normative data and the individual, the greater confidence the neuropsychologist has in determining whether the individual's performance is normal or impaired.

The goal of this article is to present normative data on a sample of highly intelligent individuals, ages 44 to 86 with estimated Intelligence Quotients of 120 and greater. This population of older individuals is thought to differ from the normal population because these individuals possess a "cognitive reserve" that allows them to perform well on neuropsychological tasks. Cognitive reserve imputes an ability to utilize various cognitive strategies and potentially recruit alternate neural networks to meet task demands (Stern, 2002). Detecting early cognitive changes that deviate from normal is particularly challenging in this population when average scores may indicate a decline from a premorbid superior baseline (Naugle, Cullum, & Bigler, 1990; Tuokko, Garrett, McDowell, Silverberg, & Kristjansson, 2003). Therefore, having normative data that has been collected on individuals with similar attributes and abilities would be advantageous.

Address correspondence to: Dorene M. Rentz, Psy. D., Division of Cognitive and Behavioral Neurology, Brigham and Women's Hospital, 221 Longwood Avenue, Boston, MA 02115. Tel.: 617-732-8235. Fax: 617-264-5212. E-mail: drentz@partners.org
Accepted for publication: November 1, 2005.

Recent evidence suggests that some memory changes in non-demented individuals represent early neurodegenerative disorders, particularly probable Alzheimer's disease (AD). An International Working Group (Winblad et al., 2004) has defined mild cognitive impairment (MCI) as a transitional state between normal cognitive function and clinically probable AD as well as other non-amnestic dementias. Despite controversies as to whether early treatment with currently approved FDA medications could delay or prevent dementia conversion (Gauthier & Touchon, 2005; Petersen & Morris, 2005; Salloway et al., 2004), neuropsychologists are being requested to identify individuals with MCI who are likely to progress to a dementia state.

Furthermore, scientific initiatives developing biological (Andreasen & Blennow, 2005; Schoonenboom et al., 2005) and neuroimaging markers of MCI (Chetelat et al., 2005; Dobert et al., 2005; Medina et al., 2005; Meyer, Quach, Thornby, Chowdhury, & Huang, 2005) depend on accurate knowledge of cognitive status in order to differentiate normal from impaired populations in a variety of research endeavors. These facts further emphasize the need for normative data that accurately represent individuals of various ages, background and abilities.

This paper presents cross-sectional data obtained at baseline from a sample that was followed longitudinally to address several concerns recently raised about normative datasets. The first is the risk of sample contamination (Sliwinski, Lipton, Buschke, & Stewart, 1996). Most norms derived from cross-sectional data demonstrate wide variability in test performance at older age ranges. In previous studies, when older individuals were followed longitudinally, those that converted to dementia had lower scores at baseline (Sliwinski et al., 1996; Sliwinski & Buschke, 1999). It has been postulated that these lower baseline scores might reflect a subgroup of individuals in preclinical stages of AD or what is now referred to as MCI (Goldman & Morris, 2001; Morris et al., 2001). We had concerns that if individuals with MCI were included in a highly intelligent normative sample, then normative scores would, on average, be lower, reducing the sensitivity of detecting early cognitive decline.

We were also concerned about cohort effects, particularly education and gender bias. While most newly derived normative datasets account for education (Ivnik et al., 1992; Ivnik, Malec, Smith, Tangalos, & Petersen, 1996; Tuokko & Woodward, 1996), it has been postulated that education may not be the best gauge of ability for everyone (Satz, 1993), particularly older cohorts of women who did not always have the same educational opportunities as men (Rentz et al., 2004). The IQ-based norms provided by this dataset would allow bright, but less-well educated women to be judged by standards more appropriate to their ability.

Finally, the data will be presented in table format so that the clinician may easily refer to them in the clinical evaluation of highly intelligent adults.

## METHODS

### Subjects

Participants were 75 volunteers (48 women, 27 men) from a larger cohort of 321 individuals enrolled in an on going prospective study of normal aging and Alzheimer's disease at Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts. The Institutional Review Board, Human Research

Committee at Brigham and Women's Hospital annually approved this study and participants gave informed consent. All subjects were living independently in the community and agreed to return for follow-up testing. They underwent a comprehensive medical and psychiatric interview as well as a neurological evaluation to rule out any major neurological disorders that might contribute to cognitive dysfunction. None of the participants had a history of alcoholism, drug abuse, or current serious neurological, medical, or psychiatric illness.

The 75 subjects selected for this analysis ranged in age from 44 to 86 years with an average of 69.3 years. They were stratified into three age cohorts (44–66, 67–72, and 73–86) to ensure an adequate number of subjects in each stratification group. Participants had stable medical conditions representative of this aged population, including allergies ($N = 5$; 6%), resolved cancers ($N = 17$; 22.7%), arthritis ($N = 12$; 16%), hypertension ($N = 17$; 22.7%), high cholesterol ($N = 10$; 13%), hypothyroidism ($N = 2$; 3%), enlarged prostate ($N = 8$; 10.7%), osteoporosis ($N = 3$; 4%), asthma or chronic obstructive pulmonary disease ($N = 8$; 10.7%), atrial fibrillation ($N = 5$; 6%), heart disease or prior myocardial infarction ($N = 5$; 6%), remote past history of traumatic brain injury without cognitive sequela ($N = 6$; 8%), and self-report of prior learning difficulties and attention deficit disorder ($N = 8$; 10.7%).

### Procedures

All participants underwent a series of neuropsychological tests commonly used in the assessment of older individuals (Rentz & Weintraub, 1999), which included the Blessed Dementia Rating Scale (BDS) (Blessed, Tomlinson, & Roth, 1968), Geriatric Depression Scale (GDS) (Yesavage et al., 1983), American National Adult Reading Test (AMNART) (Ryan & Paolo, 1992), Clinical Dementia Rating Scale Score (CDR) (Morris, 1993), Digit Span forward (DSF) and backward (DSB) (Wechsler, 1997), time to complete recitation of months of the year forward (MF) and backward (MB), word generation to the letters F-A-S (Benton, Varney, deS.Hamsher, & Spreen, 1983), category fluency to animals, fruits and vegetables (CAT) (Monsch et al., 1992), the 6-trial version of the Selective Reminding Test (SRT) (Masur et al., 1989), the 60-item version of the Boston Naming Test (BNT) (Kaplan, Goodglass, & Weintraub, 1983), and the Visual Form Discrimination Test (VFDT) (Benton et al., 1983).

Subjects were included in this analysis if they had a BDS score of less than 2, a GDS score in the normal range (score $< 11$), an estimated IQ of 120 or greater on the AMNART, and a CDR score of 0. Subjects were excluded if at any time point, they failed to meet these inclusion criteria or if a reliable informant indicated functional decline of greater than 0.5 on any box score of the CDR. These strict criteria were established to avoid including any subjects who could qualify for a diagnosis of MCI (Winblad et al., 2004).

All subjects were also required to perform within 1.5 standard deviations from the mean across all cognitive tests on the basis of published test norms adjusted for age and education, where available. In order to avoid including persons at high risk for developing a future dementia, only those individuals who remained within 1.5 standard deviations of the published normative mean for age and education over 2 or more time periods were included in this analysis. That is, subjects were excluded if at any time point they demonstrated decline from their baseline score of greater than or equal to 1.5 standard deviations from the mean based on published test norms.

### Data Analysis

All statistical analyses were performed using SPSS version 11.5. All tests were 2-tailed, with statistical significance set at $\alpha = .05$. An analysis of variance was employed to determine if there were any significant differences in demographics per age stratification. A multivariate analysis of variance (MANOVA) was performed to investigate the effects of age and gender on cognitive performance. A Bonferroni correction was used to account for multiple comparisons.

## RESULTS

### Subject Characteristics

Demographic information is presented in Table 1. Seventy-five participants returned for at least one 12-month follow-up visit and were followed on average for 4.8 years. An analysis of variance revealed no significant differences between age groups on any demographic variable.

### Effects of Age and Gender on Cognitive Measures

Multivariate analysis of variance was performed to determine whether age or gender had significant effects on cognitive performance. Gender and age group (44–66, 67–72, and 73–86) were treated as independent variables with the cognitive test scores treated as dependent variables. Results showed a significant main effect for gender only on tests of word fluency to the category "fruit," $F(1,73) = 8.41$, $p = .01$, with women outperforming men; and the BNT, $F(1,74) = 5.00$, $p = .03$, with men outperforming women. After correcting for multiple comparisons, there was also a significant main effect for age on the BNT, $F(2, 73) = 4.19$, $p = .02$, with younger aged cohorts outperforming older subjects, and on Total Recall (TR) of the SRT, $F(2,73) = 3.86$, $p = .03$, with the youngest cohort outperforming the oldest

**Table 1** Demographic data by age group

| Age group | 44–66 | | 67–72 | | 73–86 | | Total | |
|---|---|---|---|---|---|---|---|---|
| *N* | 24 | | 25 | | 26 | | 75 | |
| Male/female | 9/15 | | 7/18 | | 11/15 | | 27/48 | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| AMNART IQ | 127.1 | 3.2 | 126.6 | 3.3 | 127.9 | 3.1 | 127.2 | 3.1 |
| Education | 16.9 | 2.7 | 16.2 | 2.5 | 16.5 | 2.9 | 16.5 | 2.7 |
| BDS | .85 | .9 | .90 | 1.3 | 1.0 | 1.2 | .93 | 1.1 |
| GDS | 3.2 | 2.0 | 4.1 | 3.3 | 3.7 | 2.8 | 3.7 | 3.0 |
| CDR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Note*. AMNART = American National Adult Reading Test Intelligence Quotient, BDS = Blessed Dementia Rating Scale, GDS = Geriatric Depression Scale, CDR = Clinical Dementia Rating Scale.

**Table 2** Means of raw scores on neuropsychological measures

| | Age 44–66 $n = 24$ | | Age 67–72 $n = 25$ | | Age 73–86 $n = 26$ | |
|---|---|---|---|---|---|---|
| Measures | M | SD | M | SD | M | SD |
| DSF | 7 | (1.47) | 7 | (1.22) | 8 | (1.07) |
| DSB | 6 | (1.80) | 6 | (1.16) | 6 | (1.12) |
| MF | 4 | (1.59) | 4 | (1.27) | 4 | (1.16) |
| MB | 10 | (3.42) | 9 | (3.30) | 11 | (3.42) |
| BNT | 58[a] | (1.67) | 58[a] | (1.44) | 56[a] | (3.07) |
| Male | 57 | (1.79) | 58 | (1.90) | 58[b] | (1.12) |
| Female | 58 | (1.56) | 58 | (1.27) | 54[b] | (2.89) |
| VFDT | 31 | (0.99) | 31 | (1.18) | 31 | (1.45) |
| SRT | | | | | | |
| TR | 53[c] | (6.15) | 51 | (5.44) | 49[c] | (4.77) |
| LTS | 44 | (10.0) | 40 | (13.3) | 39 | (8.64) |
| LTR | 41 | (10.5) | 39 | (10.4) | 36 | (8.16) |
| CLTR | 33 | (13.1) | 31 | (12.2) | 26 | (7.51) |
| DR | 8 | (2.10) | 8 | (2.57) | 7 | (2.07) |
| MC | 12 | (0.38) | 12 | (0.64) | 12 | (0.64) |
| 30′ DR | 9 | (2.19) | 8 | (2.57) | 8 | (2.09) |
| 30′ MC | 12 | (0.38) | 12 | (0.64) | 12 | (0.40) |
| FAS | 51 | (12.9) | 51 | (8.85) | 51 | (11.9) |
| F | 17 | (4.85) | 17 | (3.31) | 18 | (4.97) |
| A | 16 | (4.32) | 15 | (3.78) | 15 | (4.72) |
| S | 18 | (5.27) | 19 | (3.90) | 18 | (4.35) |
| CAT | 53 | (7.28) | 53 | (8.13) | 49 | (6.45) |
| Animals | | | | | | |
| Male | 21 | (6.73) | 19 | (3.21) | 21[e] | (3.90) |
| Female | 22 | (3.71) | 21 | (3.85) | 17[e] | (2.86) |
| Vegetables | | | | | | |
| Male | 15 | (3.67) | 14 | (2.73) | 16 | (4.42) |
| Female | 17 | (2.62) | 17 | (3.85) | 15 | (2.36) |
| Fruits | | | | | | |
| Male | 13[d] | (2.92) | 14 | (2.93) | 15 | (2.02) |
| Female | 17[d] | (2.41) | 16 | (2.64) | 15 | (2.67) |

[a]The 73–86 age cohorts named significantly less items on the BNT compared to both the 44–66 age cohorts, $p = .003$, and the 67–72 age cohorts, $p = .006$. DSF = WAIS-III Digit Span Forward subtest; DSB = WAIS-III Digit Span subtest; MF = Months recited forward in seconds; MB = Months recited backward in seconds; VFDT = Visual Form Discrimination Test; SRT = Selective Reminding Test; LTS = Long-Term Storage; LTR = Long-Term Retrieval; CLTR = Consistent Long-Term Retrieval; DR = Delayed Recall; MC = Multiple Choice; 30′DR = 30 minute delayed recall; 30′MC = 30 minute delayed multiple choice; FAS = total words generated to letters F-A-S in 60 seconds per letter; CAT = total words generated to categories Animals, Vegetables, and Fruits in 60 seconds per category.

[b]Women named significantly less items than men at the oldest age range.

[c]The 73–86 age cohort remembered significantly less words on the SRT TR than the 44–66 age cohort, $p = .031$.

[d]Women in the 44–66 age cohort performed significantly better on Fruits, $p = .005$.

[e]The men in the 73–86 age cohort performed significantly better on Animals, $p = .030$. There were no other significant effects for age or gender.

cohort. Delayed Recall (DR) approached significance, $F(2,73) = 3.10$, $p = .05$, again with the young outperforming the old.

Age by gender interactions were significant for generating words to the category "animals," $F(2,73) = 3.45$, $p = .04$, with men outperforming women at older age ranges; the total category score (CAT), $F(2,73) = 5.23$, $p = .01$, with men outperforming women in the youngest age range but women outperforming men at the oldest age range; and the BNT, $F(2,73) = 12.68$, $p = .01$, with men outperforming women in the oldest age range. Means for these cognitive measures are presented in Table 2.

Due to the significant findings for gender on the BNT and word fluency to categories (i.e., Animals and Fruits), norms for these measures were stratified by gender as well as age groups. Percentiles of raw scores are presented in Tables 3–8.

## DISCUSSION

The goal of this study was to provide normative data from a sample of highly intelligent individuals. The purpose was twofold: to establish a typical test performance profile on commonly used neuropsychological tests in this unique population and to provide clinically useful norms for identifying at risk individuals who could progress to a dementia state. To avoid including individuals in the early stages of a progressive dementia, we carefully selected subjects who scored within the normal range on all cognitive tests for at least a 2-year period with an average duration of follow-up being approximately 4 years.

Not surprisingly, mild age effects were found on BNT and TR from the SRT, indicating a slight decline in naming and memory acquisition across age groups. These findings are consistent with other reports in the literature of age-related changes in naming (Ivnik et al., 1996; Mackay, Connor, & Storandt, 2005; Saxton et al., 2000) and memory acquisition (Jacobs et al., 1995; Masur, Fuld, Blau, Crystal, & Aronson, 1990; Masur, Sliwinski, Lipton, Blau, & Crystal, 1994; Petersen, Smith, Ivnik, Kokmen, & Tangelos, 1994) in cognitively normal older populations.

We found no statistically significant age related differences on measures of attention, memory recall, and visuospatial function when analyses were corrected for multiple comparisons. These findings suggest that in this sample of highly intelligent individuals, cognitive performance was similar across age groups.

Gender differences were found on category fluency tests. Men outperformed women in animal generation but women outperformed men in fruit generation. There were no significant differences by gender in vegetable fluency or in the total score for Categories or FAS. Bolla, Gray, Resnick, Galante, & Kawas (1998) also found gender differences in a sample of highly educated older adults with women outperforming men on vegetable and fruit generation but not animal generation or the FAS total score (Bolla et al., 1998). Since performance on category and letter fluency tasks is widely used to differentiate early Alzheimer's disease (Butters, Granholm, Salmon, Grant, & Wolfe, 1987; Cooper, Lacritz, Weiner, Rosenberg, & Cullum, 2004; Hodges, Patterson, Oxbury, & Funnell, 1992; Monsch et al., 1992; Taylor, Salmon, Monsch, & Brugger, 2005) from other forms of dementia (Baldo & Shimamura, 1998; Hodges et al., 1992; Kitabayashi et al., 2001; Monsch et al., 1992), providing gender stratifications in norms for highly intelligent individuals has important diagnostic implications.

**Table 3** Percentiles for raw scores (ages 44–66, $N = 24$)

| | | | | | | | | | | Six-trial Selective Reminding Test | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentile | DSF | DSB | MF | MB | FAS | F | A | S | VFDT | TR | LTS | LTR | CLTR | DR | MC | 30′DR | 30′MC |
| 5 | 4 | 3 | 2 | 6 | 25 | 8 | 8 | 8 | 29 | 39 | 22 | 19 | 4 | 4 | 11 | 4 | 11 |
| 10 | 5 | 4 | 3 | 6 | 35 | 12 | 10 | 11 | 30 | 43 | 24 | 21 | 15 | 5 | 11 | 7 | 11 |
| 25 | 6 | 4 | 3 | 7 | 43 | 13 | 12 | 14 | 30 | 49 | 41 | 39 | 26 | 7 | 12 | 7 | 12 |
| 50 | 8 | 6 | 4 | 9 | 50 | 16 | 15 | 19 | 32 | 54 | 45 | 42 | 33 | 9 | — | 9 | — |
| 75 | 9 | 7 | 5 | 12 | 63 | 19 | 20 | 23 | — | 57 | 49 | 47 | 40 | 10 | — | 11 | — |
| 90 | — | 9 | 7 | 16 | 70 | 25 | 22 | 25 | — | 60 | 55 | 52 | 49 | 12 | — | 12 | — |
| 95 | — | — | 9 | 17 | 74 | 27 | — | 28 | — | 65 | 64 | 63 | 62 | — | — | — | — |

*Note*. WAIS III = Wechsler Adult Intelligence Scale—Version III, DSF = Digit Span Forward subtest, DSB = Digit Span Backward subtest, MF = Months Forward (in seconds), MB = Months Backward (in seconds), FAS = Total combined number of words to F = A-S, VFDT = Visual Form Discrimination Test, TR = SRT Total Recall, LTS = SRT Long-Term Storage, LTR = SRT Long-Term Retrieval, CLTR = SRT Consistent Long-Term Retrieval, 30′DR = SRT 30-minute Delayed Free Recall, 30′MC = SRT 30-minute Delayed Multiple Choice.

**Table 4** Percentiles for raw scores by gender (ages 44–66) (males, $N = 9$; females, $N = 15$)

| | Boston Naming Test and Category Generation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BNT | | CAT | | Animals | | Vegetables | | Fruits | |
| Percentile | M | F | M | F | M | F | M | F | M | F |
| 5 | 55 | 55 | 41 | 45 | 14 | 14 | 10 | 14 | 8 | 12 |
| 10 | 55 | 55 | 41 | 47 | 14 | 15 | 10 | 14 | 8 | 13 |
| 25 | 56 | 57 | 43 | 49 | 17 | 19 | 13 | 14 | 11 | 15 |
| 50 | 57 | 58 | 48 | 54 | 22 | 24 | 14 | 16 | 14 | 16 |
| 75 | 59 | 60 | 56 | 61 | 24 | 24 | 17 | 19 | 16 | 19 |
| 90 | — | — | — | 66 | — | 26 | — | 21 | — | 20 |
| 95 | — | — | — | — | — | — | — | — | — | — |

*Note*. BNT = Boston Naming Test, CAT = Category Generation Test and presents the total combined number of words to categories Animals, Vegetables, and Fruits.

Despite the small sample size, a major strength of this article lies in the fact that the cross-sectional norms consist of baseline data from a carefully selected longitudinal sample from which subjects with any significant objective memory or functional decline were prospectively eliminated to avoid including into the normative dataset individuals in early stages of a dementing illness. However, we recognize that the normative data presented in this paper cannot be generalized to all individuals because these norms are derived from the test performance of a select group of largely well-educated, highly intelligent and Caucasian individuals. They can only be applied in the context of evaluations of individuals of similar intelligence and background. The establishment of normative data from highly intelligent older individuals of diverse ethnic and educational backgrounds is also important and we are in the process of collecting such data. Nevertheless, the subjects included

**Table 5** Percentiles for raw scores (ages 67–72, $N = 25$)

| | | | | | | | | | | Six-trial Selective Reminding Test | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentile | DSF | DSB | MF | MB | FAS | F | A | S | VFDT | TR | LTS | LTR | CLTR | DR | MC | 30′DR | 30′MC |
| 5 | 5 | 4 | 3 | 6 | 35 | 11 | 7 | 13 | 28 | 40 | 9 | 21 | 8 | 3 | 9 | 3 | 10 |
| 10 | 5 | 4 | 3 | 6 | 37 | 12 | 9 | 15 | 30 | 44 | 25 | 25 | 14 | 4 | 11 | 4 | 11 |
| 25 | 7 | 5 | 3 | 7 | 47 | 15 | 13 | 16 | 30 | 47 | 31 | 31 | 25 | 6 | 11 | 6 | 11 |
| 50 | 8 | 5 | 4 | 8 | 52 | 18 | 14 | 18 | 32 | 51 | 40 | 38 | 31 | 8 | 12 | 9 | 12 |
| 75 | 8 | 6 | 5 | 12 | 57 | 20 | 17 | 24 | — | 55 | 49 | 46 | 40 | 10 | — | 11 | — |
| 90 | 8 | 7 | 6 | 15 | 61 | 21 | 20 | 25 | — | 59 | 58 | 55 | 51 | 11 | — | 11 | — |
| 95 | 9 | 8 | 7 | 17 | 69 | 23 | 23 | — | — | 62 | 63 | 58 | 53 | — | — | 12 | — |

*Note*. WAIS III = Wechsler Adult Intelligence Scale—Version III, DSF = Digit Span Forward subtest, DSB = Digit Span Backward subtest, MF = Months Forward (in seconds), MB = Months Backward (in seconds), FAS = Total combined number of words to F = A-S, VFDT = Visual Form Discrimination Test, TR = SRT Total Recall, LTS = SRT Long-Term Storage, LTR = SRT Long-Term Retrieval, CLTR = SRT Consistent Long-Term Retrieval, 30′DR = SRT 30-minute Delayed Free Recall, 30′MC = SRT 30-minute Delayed Multiple Choice.

**Table 6** Percentiles for raw scores by gender (ages 67–72) (males, $N = 7$; females, $N = 18$)

| | Boston Naming Test and Category Generation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BNT | | CAT | | Animals | | Vegetables | | Fruits | |
| Percentile | M | F | M | F | M | F | M | F | M | F |
| 5 | 55 | 55 | 40 | 40 | 15 | 15 | 10 | 15 | 11 | 10 |
| 10 | 55 | 56 | 40 | 42 | 15 | 15 | 10 | 15 | 11 | 12 |
| 25 | 56 | 57 | 40 | 49 | 16 | 18 | 12 | 18 | 13 | 16 |
| 50 | 57 | 58 | 48 | 56 | 19 | 21 | 16 | 21 | 13 | 17 |
| 75 | 60 | 59 | 54 | 61 | 22 | 24 | — | 24 | 16 | 17 |
| 90 | — | — | — | 64 | — | 26 | — | 26 | — | 20 |
| 95 | — | — | — | — | — | — | — | — | — | — |

*Note*. BNT = Boston Naming Test, CAT = Category Generation Test and presents the total combined number of words to categories Animals, Vegetables, and Fruits.

in this normative dataset did not differ from the general population with regards to health status or medications. They reported stable diseases typical for this age group and these conditions were controlled on standard medications at the time of testing.

The goals of this study were to provide the clinician with normative data for identifying a typical cognitive performance in highly intelligent individuals and provide a useful guide for detecting abnormal cognitive decline in those individuals at-risk for progressive dementia. Taking into consideration the caveats described above, we anticipate that these data will fill an existing gap in the current normative literature and improve the utility of neuropsychological assessment for highly intelligent older individuals.

**Table 7** Percentiles for raw scores (ages 73–86, $N = 26$)

| | | | | | | | | | | Six-trial Selective Reminding Test | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentile | DSF | DSB | MF | MB | FAS | F | A | S | VFDT | TR | LTS | LTR | CLTR | DR | MC | 30′DR | 30′MC |
| 5 | 5 | 4 | 3 | 7 | 35 | 10 | 7 | 12 | 27 | 40 | 24 | 22 | 14 | 3 | 10 | 4 | 11 |
| 10 | 6 | 4 | 3 | 8 | 37 | 12 | 9 | 12 | 29 | 43 | 28 | 25 | 15 | 4 | 11 | 5 | 11 |
| 25 | 7 | 5 | 4 | 8 | 40 | 14 | 12 | 15 | 30 | 45 | 33 | 30 | 18 | 5 | 11 | 7 | 12 |
| 50 | 8 | 6 | 4 | 10 | 49 | 17 | 16 | 17 | 31 | 48 | 38 | 36 | 27 | 7 | 12 | 8 | — |
| 75 | 8 | 6 | 5 | 12 | 62 | 21 | 18 | 19 | 32 | 52 | 45 | 40 | 33 | 8 | — | 10 | — |
| 90 | 9 | 7 | 6 | 15 | 70 | 26 | 23 | 26 | — | 55 | 53 | 49 | 36 | 10 | — | 11 | — |
| 95 | — | 8 | 7 | 21 | 74 | 27 | 24 | 27 | — | 58 | 57 | 53 | — | — | — | — | — |

*Note*. WAIS III = Wechsler Adult Intelligence Scale—Version III, DSF = Digit Span Forward subtest, DSB = Digit Span Backward subtest, MF = Months Forward (in seconds), MB = Months Backward (in seconds), FAS = Total combined number of words to F = A-S, VFDT = Visual Form Discrimination Test, TR = SRT Total Recall, LTS = SRT Long-Term Storage, LTR = SRT Long-Term Retrieval, CLTR = SRT Consistent Long-Term Retrieval, 30′DR = SRT 30-minute Delayed Free Recall, 30′MC = SRT 30-minute Delayed Multiple Choice.

**Table 8** Percentiles for raw scores by gender (ages 73–86) (males, $N = 11$; females, $N = 15$)

| | Boston Naming Test and Category Generation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BNT | | CAT | | Animals | | Vegetables | | Fruits | |
| Percentile | M | F | M | F | M | F | M | F | M | F |
| 5 | 57 | 50 | 41 | 41 | 13 | 13 | 8 | 12 | 11 | 11 |
| 10 | 57 | 51 | 41 | 41 | 14 | 14 | 9 | 13 | 11 | 12 |
| 25 | 57 | 52 | 45 | 43 | 19 | 15 | 12 | 13 | 13 | 14 |
| 50 | 58 | 54 | 52 | 46 | 21 | 16 | 17 | 14 | 16 | 15 |
| 75 | 59 | 57 | 58 | 49 | 24 | 19 | 20 | 16 | 16 | 17 |
| 90 | 60 | 58 | 60 | 59 | 27 | 22 | 22 | 20 | 17 | 19 |
| 95 | — | — | — | — | — | — | — | — | — | — |

*Note.* BNT = Boston Naming Test, CAT = Category Generation Test and presents the total combined number of words to categories Animals, Vegetables, and Fruits.

## ACKNOWLEDGEMENTS

This study was supported by grants from the Harvard Center for Neurodegeneration and Repair and the Charles H. Farnsworth Trust, Boston, MA. We wish to express special appreciation to all our subjects who contributed to this study on an annual basis.

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