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Cognitive Performance in Centenarians and the Oldest Old: Norms from the Georgia Centenarian Study

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Abstract

We present normative data from a large population-based sample of centenarians for several brief, global neurocognitive tasks amenable for frail elders. Comparative data from octogenarians are included. A total of 244 centenarians and 80 octogenarians from Phase III of the Georgia Centenarian Study were administered the Mini-Mental Status Examination, Severe Impairment Battery, and Behavioral Dyscontrol Scale. Centenarians (age 98–107) were stratified into three age cohorts (98–99, 100–101, 102–107), octogenarians into two 5-year cohorts (80–84, 85–89). Highly significant differences were observed between groups on all measures, with greater variation and dispersion in performance among centenarians, as well as stronger associations between age and performance. Descriptive statistics and normative ranges (unweighted and population-weighted) are provided by age cohort. Additional statistics are provided by education level. While most previous centenarian studies have used convenience samples, ours is population-based and likely more valid for comparison in applied settings. Results suggest centenarians look different than do even the oldest age range of most normative aging datasets (e.g., 85–90). Results support using global measures of neurocognition to describe cognitive status in the oldest old, and we provide normative comparisons to do so.

Keywords

Normative; Centenarians; Cognition; MMSE; SIB; BDS; Population-based

INTRODUCTION

The number of centenarians continues to accelerate at a phenomenal rate in the USA, doubling from the mid 1970s to the mid 1990s (Day, 1996). Although age verification can often be a

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problematic issue in generating accurate counts of centenarians (Perls et al., 1999; Rosenwaike & Stone, 2003), it has recently been estimated that fully half of all children born today can expect to live until their hundredth birthday (Christensen, Doblhammer, Rau, & Vaupel, 2009). Census data recorded 37,000 centenarians in 1990 and 50,454 centenarians in 2000 (Wan, Sengupta, Velkoff, & DeBarros, 2005). Kestenbaum and Ferguson (2006) used Medicare data to obtain revised estimates of approximately 32,920 centenarians in the US around 2000. Other countries with large centenarian populations in 2000 include Japan (11,546), France (8,752), England and Wales (6,320), Italy (5,438), and Germany (4,295).

This explosion has far outpaced the availability of high quality normative data on domains such as cognitive performance for researchers and clinicians alike. There is a need for normative data on this age group for several reasons. First, as age is the greatest risk factor for Alzheimer's disease (AD), the most common form of dementia (Stern et al., 1994), centenarians are an exceptionally vulnerable population to AD, and thus may require clinical evaluation of cognitive functioning at an increased rate relative to younger aging cohorts. Second, little is known about what characterizes `normal' aging in this cohort, and what constitutes dementia. Some researchers point to longevity as a marker for resilience and suggest that this age group should thus be less susceptible to age-associated cognitive decline (e.g., Perls, Morris, Ooi, & Lipsitz, 1993), while others suggest that rates of dementia in centenarians are higher than younger cohorts of older adults (Hagberg, Alfredson, Poon, & Homma, 2001). Thus, it is unclear if age-associated cognitive decline simply continues in a linear trajectory in the oldest-old, or if there is a plateau in cognitive decline in this cohort due to resilient, more cognitively intact individuals surviving to oldest age. Finally, there is considerable heterogeneity in the normal aging process in centenarians, but it is important to determine if there is a general normative pattern of cognitive decline that is characteristic of this cohort, and that is possibly distinct from other aging cohorts. For example, in a study summarizing the results from three separate centenarian studies, Hagberg et al. (2001) found that in a Japanese centenarian study, centenarians performed worse on a global measure of cognition than a comparison group of 70-year-olds who were at equal stages on a dementia staging measure, and that cognitive decline in centenarians with dementia showed a more rapid progression than cognitive decline in a comparison group of 70-year-olds with dementia.

While there have been a number of large and small studies following centenarians (e.g., Andersen-Ranberg, Vasegaard, & Jeune, 2001; Hagberg et al., 2001; Silver, Jilinskaia, & Perls, 2001), cognitive performance has not been carefully studied, particularly in a population-based sample of centenarians. This is in part due to the difficulty in identifying appropriate measures that can be used to measure cognition in a sometimes very frail population, as well as the difficulty in identifying measures that can provide useful data in both centenarians and other representative age cohorts (Silver et al., 2001). Further, most samples that do attempt to collect cognitive measures on centenarians have used `convenience' samples, which may lack generalizability to the general centenarian population. In contrast, Phase III of the Georgia Centenarian Study is a population-based comprehensive and multi-disciplinary study of centenarian functioning. Both the recruitment strategy, as well as post-construction analyses were designed to accurately represent the entire range of functioning among the centenarian population in 44 counties of Northeast Georgia (Poon et al., 2007).

The purpose of this study is to provide initial descriptions of cognitive performance of a large population-based sample of centenarians in a comparative format. Normative data for three brief but global neurocognitive assessment tools amenable for the oldest old are provided. These are the Mini-Mental Status Exam (Folstein, Folstein, & McHugh, 1975), the Severe Impairment Battery (Saxton, McGonigle-Gibson, Swihart, Miller, & Boller, 1990), and the Behavioral Dyscontrol Scale (Grigsby, Kaye, & Robbins, 1992; Grigsby & Kaye, 1996). Corresponding data from a smaller cohort of octogenarians is included for comparison.

METHODS

Population-Based Sampling Summary

Few studies of centenarians have used a true population-based sample. A summary of our sampling process is provided here (for greater detail, see Poon et al., 2007). Our centenarian sample came from 44 counties in northeast Georgia. Our sampling method had two components. The first consisted of a census of all skilled nursing facilities (SNFs) and personal care homes (PCHs) located in our 44-county area and the identification of all residents of a sample of those facilities who were aged 98 and older. Lists were generated of the SNFs and PCHs in each county and of the number of beds in each of those facilities. Interviewers called on each of the selected facilities, explained the study, and requested the names of all centenarians and near-centenarians currently residing in that facility. The second component relied on lists of registered voters, again across the entire 44-county area, and using date-of-birth information to identify individuals who were age 98 and older. Interviewers made calls in order to recruit these community-dwelling centenarians. There was some overlap between these methods (that is, some residents of SNFs and PCHs were also found on voter registration lists), but the voter registration lists contained a much higher proportion of the non-institutionalized than of the institutionalized. To achieve control over the number of participants and maximize the proportion of respondents who were over age 100, the 44 counties were divided into four strata, defined to be mostly contiguous and with approximately the same number of centenarians according to the 2000 census population enumeration. The target population for each of the four strata was defined as persons residing within the geographic boundaries of the stratum who were age 98 or older by the beginning of the field period for that stratum. We listed all centenarians and near-centenarians (that is, all individuals who had their 98th birthday on or before the date of the start of data collection in a given stratum), who were on the voter registration file and whose address indicated that they resided in one of the counties in that stratum.

Comparisons with special tabulations from the 2000 census data and Centers for Medicare and Medicaid Services (Arnold et al., 2010) suggested the sample was broadly representative of the underlying population. Likewise, our achieved sample represented fully 19.6% of all centenarians living in these 44 counties. In order to adjust for remaining known differences between our sample and the population, sampling weights (normed to reflect the observed sample size) were developed. Creation of weights was based primarily on an iterative post-stratification approach designed to bring the weighted sample distribution into close agreement with the target population on five characteristics (county of residence, age, gender, race, and type of residence) obtained from the 2000 Census. We adjusted first on one of the five characteristics (substratum), and then readjusted on cross-tabulation of successive pairs of the remaining four characteristics. These steps were repeated until a stable set of weights was achieved from one iteration to the next. The process is described in full detail in a working paper by Rodgers (2008). Results from both weighted and unweighted analyses are reported. As this was a population-based study, all participants were evaluated regardless of their physical or cognitive status. Participants were evaluated across multiple sessions, with data collected on physical and mental health, cognition, functional capacity, genetics, nutrition, resources and adaptations, and personality as part of the larger GCS study. In addition, the 80 octogenarians (age 80–89) were recruited as a control group and had identical data collected. Based on the proportion of institutionalized octogenarians according to the 2000 census, we recruited approximately 85% of the sample of octogenarians from the voter registration rolls and 15% from the SNF and PCH sites in those same counties. All participants or their legal proxy provided informed written consent prior to participating. All test administration was conducted by trained GCS research assistants.

Participants

As above, participants were from a population-based sample of 244 community-dwelling and institutionalized centenarians and near centenarians and 80 octogenarians from the Georgia Centenarian Study (GCS). From start to finish, 552 persons were asked to participate (174, 80–90 year olds; 378, 98+ year olds). Ninety-four 80–90-year-old participants recruited declined to participate leaving an *N* of 80. One hundred and twenty-nine 98+ years old participants recruited declined to participate, while an additional five died prior to completion of these portions of the overall study leaving an *N* of 244. These 324 total participants were administered a cognitive battery that included the Mini-Mental Status Examination (MMSE), the Severe Impairment Battery (SIB), and the Behavioral Dyscontrol Scale (BDS). Centenarians (defined as age range 98–107) were divided into 2-year range cohorts (98–99 and, 100–101) and a final age cohort range of (102–107), the latter ages collapsed together because of sample size limitations. Octogenarians were divided into two 5-year cohorts (80–84, 85–89). As a result, the average age of the centenarian sample was 100.6 years ($SD = 2.04$) and average education was 10.6 years ($SD = 3.78$). The centenarian sample was predominantly female ($n = 207$, 85%), Caucasian ($n = 192$, 79%), and 37% were living independently ($n = 91$). The average age of the octogenarian sample was 84.3 years ($SD = 2.78$), and average education was 12.9 years ($SD = 3.52$). The octogenarian sample was predominantly female ($n = 53$, 66%), Caucasian ($n = 66$, 83%), and 84% were living independently ($n = 67$).

Descriptive statistics and normative ranges are provided for all tasks by age cohort in tablature format. Unweighted and population-weighted scores, as well as preliminary education level subgroup score ranges are additionally provided. This study was approved by the University of Georgia Institutional Review Board. Depending on the number of sessions completed, participants were paid up to $600 compensation for their participation in the larger study.

Measures

Mini-Mental Status Examination (Folstein et al., 1975)—One of the most widely used assessments of mental status, the MMSE is used as a screening tool for cognitive impairment. It is made up of 11 items that generate a score ranging from 0 to 30. The MMSE assesses orientation to time and place, immediate and short-delayed recall of three words, attention, calculation, language, and visual construction. The original MMSE was developed to discriminate demented from nondemented psychiatric patients and MMSE scores showed excellent test–retest reliability over both 2 day ($r = .89$, psychiatric nondemented controls) and 4-week intervals ($r = .99$, demented patients; Folstein et al., 1975). These original reliability findings have generally withstood the test of time (McCaffrey, Duff, & Westervelt, 2000). While significantly affected by age and education, age/education adjusted normative data have been published over the years (e.g., Bravo & Hebert, 1997; Dore, Elias, Robbins, Elias, & Brennan, 2007; Tombaugh, McDowell, Kristjansson, & Hubley, 1996), but generally not above age 90. While considerable MMSE centenarian data have been reported (e.g., Andersen-Ranberg et al., 2001; Gondo et al., 2006; Holtsberg et al., 1992; Holtsberg, Poon, Noble, & Martin, 1995; Kliegel & Sliwinski, 2004; Perls et al., 1993), they have either not been population-based, or not provided in a format conducive for later normative comparisons. We used the MMSE raw score in the analyses and in the normative tables below. MMSE administration followed minor modifications as described in Holtsberg et al. (1995). Specifically, participants performed both the `Serial 7s' and the spelling of `WORLD' backwards items, and received the higher of the two scores. Items participants refused to, or were unable to, perform were scored as `incorrect'.

Severe Impairment Battery (SIB; Saxton et al., 1990)—The SIB was developed to be used with significantly cognitively impaired individuals and to provide useful information at the lower levels of performance. It was used in this study as a primary measure of global cognitive performance. The SIB has numerous advantages for use in a frail population such as Centenarians, as items are quite simple and designed to minimize floor effects. Items are one-step questions or commands, and it also makes use of gestural cues, so is particularly amenable to testing persons with hearing impairment, common in the oldest old. The SIB consists of cognitive subscales that are generally downward extensions of items often seen in other screening instruments. Scores from the SIB have demonstrated good inter-rater reliability (r = 0.87–1.00), as well as test–retest reliability in a group of demented older adults up to their early 90s over a two week interval (Saxton et al., 1990). Validity has been supported through moderate to high correlations with MMSE items in elders (Saxton et al., 1990) as well as the Vineland Adaptive Behavior Scales in Down's syndrome adults (Witts & Elders, 1998). The SIB has been shown to provide a varied range of scores in participants with MMSE scores less than 12 (Panisset, Roudier, Saxton, & Boller, 1994). The SIB has been translated to several languages including French, Italian, and Spanish versions. As with any measure effective in identifying severe impairment, the SIB is susceptible to ceiling effects in those with less severe cognitive impairment (Boller, Verny, Hugonot-Diener, & Saxton, 2002). The SIB is made up of 40 items divided into nine subscales (Social Interaction, Memory, Orientation, Language, Attention, Praxis, Visuospatial Ability, Construction, Orientation to Name) with a total score range of 0–100. All items are presented by an assessor as single questions or commands and accompanied by gestural cues if needed (Saxton et al., 1990). A simple summing of scores is done for each subscale as well as the total SIB score.

Behavioral Dyscontrol Scale (BDS, Grigsby et al., 1992; Grigsby & Kaye, 1996)—The BDS was developed as a brief screening measure of executive functioning. It is a short, nine item test, primarily evaluating motor control processes. Seven of the items directly assess motor control, while an additional item assesses sequencing and a final item assesses interviewer-identified insight. All but the insight item are scored on a 0–2-point scale, with the insight item on a 0–3-point scale. A total score is the sum of all items, ranging from 0 to 19. BDS scores have shown high interrater reliability (ICC = 0.98), internal consistency, and test–retest reliability (Grigsby et al., 1992). The first eight items are presented by the assessor in an interview format, while the final item is based on the judgment of the interviewer following performance of the first 8 items. Instructions are detailed in the manual (Grigsby & Kaye, 1996). A simple summing of scores is done to generate the total BDS score.

RESULTS

Overall performance of centenarians as a group and octogenarians as a group are provided in Table 1, as well as a statistical comparison of group differences. This same information can be seen in Figures 1–3 by age cohort. As would be expected, highly significant differences were found between groups on virtually all neurocognitive measures. Importantly, centenarians showed significantly greater variation and dispersion of scores in their neurocognitive performance compared to octogenarians. This increased as age increased.

A correlation matrix of the tasks for each group (octogenarians and centenarians) is provided in Table 2 for further descriptive comparison purposes. Evaluation of the correlations indicates that, for octogenarians, age correlated negatively with BDS scores. For centenarians, age correlated negatively with all three measures. Education was significantly correlated with all tasks in each group. Finally, all of the cognitive measures were correlated positively with one another in each group.

Table 3 provides statistical descriptions of each scale by age cohort including N, mean, standard deviation, and minimum and maximum scores. As can be seen in the table, mean MMSE, SIB, and BDS fall at every increased age increment. At the same time, the spread of scores tends to expand (see increasing standard deviations) as age increases as well. Note that within each age cohort across all three measures, the range of scores goes from 0 or near 0 to perfect or near perfect performance.

Normative results are presented in table form for each task. Table 4 provides the *N* for each age group and *mean* score at specific percentiles for each age cohort for each measure. For comparative purposes, population-weighted scores are provided in parentheses alongside each score. Similar to mean scores, percentiles show a steady decrease in scores at all centile levels for all three measures.

Table 5 provides the *N* for each age group and *mean* score at specific percentiles further divided by dichotomized education level (below high school; at or above high school) for each age cohort for each measure. Again, population-weighted scores are provided in parentheses alongside each score. Of note, the smaller *N*s indicate somewhat greater variability but still significant decreases in scores across most centile levels for both educational levels.

DISCUSSION

While the majority of previous studies of centenarians have used convenience samples, Phase III of the GCS provides normative data on a population-based sample of centenarians. As a result, we expect these results to be more applicable for comparison in applied settings such as assisted living, skilled nursing homes, and physician and clinic offices. Three well-validated measures of cognitive performance – MMSE, SIB, and BDS – provide a significant expansion of the kinds of cognitive abilities we are able to measure in the oldest old. Not surprisingly, our results suggest that centenarians in fact look very different on cognitive testing than do even the oldest age ranges of most normative aging datasets (e.g., 80–90). However, results support the use of both global (e.g., MMSE, SIB) and domain-specific (e.g., BDS) measures of neurocognition to describe cognitive abilities in this oldest old cohort, and these normative tables should provide a significantly improved set of comparison scores in which to do so. For convenience, we have provided both age cohort means and standard deviations (Table 3) as well as centile scores within specific age cohorts (Tables 4 and 5).

Several aspects of our study should be noted. Importantly, as this was a population-based study, no filtering for dementia was conducted. Earlier studies of centenarians have reported considerable dementia in their samples, ranging from 42 to 100% (see Gondo & Poon, 2007, for a review). As can be seen in our population, the average centenarian shows significant cognitive impairment as reflected in all of our primary measures, albeit as a group showing considerable variability. Further, cognitive performance across all measures drops significantly per each age cohort, underscoring the increased significance of small changes in age for these oldest old as well as the need to compare against more exact ages. This pattern is strikingly seen in Figures 1–3.

We also provided statistical population-adjusted weighted scores for all age and centile groups in addition to our actual scores. While these generally differed only slightly, and primarily at the high and low ends of the performance ranges, we felt they were important to include for aging researchers who might need a strict population estimate from which to compare.

A limitation of our tables is the lack of separation of our groups by residential status, i.e., community dwelling versus institutionalization. Unfortunately, our participant numbers were too small to provide stable scores for these subgroups. For preliminary consideration, we additionally provided cohorts divided by an educational dichotomy – less than high school and high school or better. The cohort `N's for these subgroups are obviously small at the extreme ends, and we want to acknowledge that these should thus be used cautiously. Another limitation of all centenarian studies is the potential impact of sensory deficit or motor impairment on performance. In our study, persons unable to complete an item of a task due to sensory or motor impairment were given a `0' for that item. Thus, this should be kept in mind for comparison. Still, we hope that as a group, these tables allow researchers and clinicians to gain a sense of where their oldest old patients/participants/clients stand compared to their peers and thus allow them to make reasoned judgment of relative cognitive ability.

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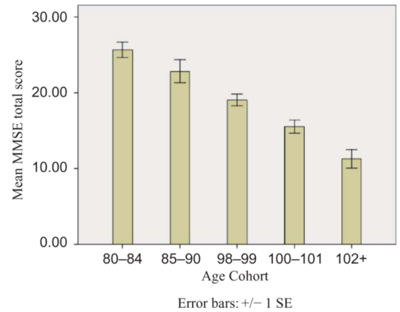

Figure 1.
MMSE scores by age cohorts.

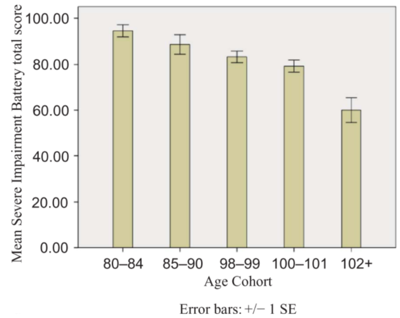

Figure 2.
SIB scores by age cohorts.

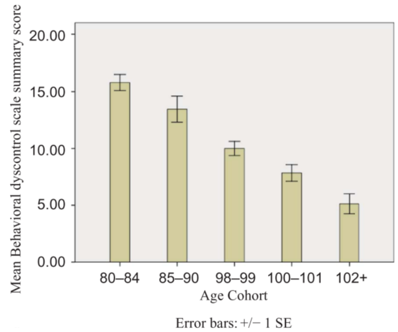

Figure 3.
BDS scores by age cohorts.

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Table 1

Comparisons of Scale Means by Age Group

Age Group	N	M	SD	df	F	Partial η^2	Mean Diff
			Mini-Mental State Examination				
Octogenarian	80	24.45	7.93	1,322	55.46*	.147	8.25
Centenarian	244	16.20	8.81				
			Severe Impairment Battery				
Octogenarian	80	91.97	21.29	1,310	62.32*	.167	14.99
Centenarian	244	76.98	29.60				
			Behavioral Dyscontrol Scale				
Octogenarian	80	14.76	5.76	1,318	17.48*	.052	6.50
Centenarian	232	8.26	6.54				

* $p < .001$.

Table 2

Correlations Between Tasks by Age Group

Variable		Age	Education	MMSE	SIB	BDS
Age	*r*		.025	−.192	−.123	−.249*
	N		80	80	80	80
Education	*r*	−.093		.368**	.238*	.393**
	N	237		80	80	80
MMSE	*r*	−.340**	.375**		.877**	.898**
	N	244	237		80	80
SIB	*r*	−.306**	.350**	.838**		.784**
	N	240	233	240		80
BDS	*r*	−.324**	.323**	.839**	.691**	
	N	232	225	232	232	

Note. Correlations for Octogenarians are shown above the diagonal. Correlations for Centenarians are shown below the diagonal. Age, age in years; Education, highest grade completed; MMSE, Mini-mental State Exam; SIB, Severe Impairment Battery Total Score; BDS, Behavioral Dyscontrol Summary Score.

* $p < .05$

** $p < .01$.

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Table 3

Descriptive Statistics by Age Cohort

Age cohort	N	M	SD	Min	Max
		Mini-Mental State Examination			
80–84	45	25.69	6.92	0	30
85–89	35	22.86	8.92	0	30
98–99	109	19.04	8.22	0	30
100–101	83	15.54	8.03	0	29
102+	52	11.29	8.96	0	30
		Severe Impairment Battery			
80–84	45	94.55	17.68	2	100
85–89	35	88.64	25.08	2	100
98–99	107	83.29	26.00	0	100
100–101	82	79.30	23.62	0	100
102+	51	60.01	38.25	0	100
		Behavioral Dyscontrol Scale			
80–84	45	15.80	4.70	0	19
85–89	35	13.42	6.72	0	19
98–99	106	10.00	6.35	0	19
100–101	78	7.82	6.40	0	19
102+	48	5.13	5.99	0	17

Table 4

Centiles by Age Cohort

	Age Cohort (Weighted Score in Parentheses)				
%ile	**80–84**	**85–89**	**98–99**	**100–101**	**102+**
			Mini-Mental State Examination		
5th	<4 (1)	<2 (4)	1 (1)	<1 (4)	– (–)
10th	18 (16)	6 (9)	5 (8)	6 (8)	0 (–)
25th	26 (26)	21 (26)	15 (15)	11 (12)	<1 (0)
50th	28 (28)	27 (28)	21 (21)	15 (16)	12 (13)
75th	29 (29)	28 (29)	26 (26)	21 (25)	18 (19)
90th	30 (30)	29 (30)	28 (28)	28 (29)	24 (24)
95th	– (–)	30 (–)	29 (29)	29 (–)	25 (25)
N	*45(51)*	*35 (29)*	*109(133)*	*83(72)*	*52(39)*
			Severe Impairment Battery		
5th	<45 (35)	10 (21)	<9 (25)	<22 (51)	– (0)
10th	92 (92)	50 (75)	35 (47)	53 (59)	2 (2)
25th	98 (98)	95 (96)	84 (84)	72 (78)	19 (5)
50th	99 (99)	98 (98)	94 (94)	89 (91)	77 (86)
75th	100 (100)	99 (99)	98 (98)	95 (96)	95 (96)
90th	–	100 (100)	100 (100)	99 (99)	98 (98)
95th	–	–	–	– (100)	100 (100)
N	*45(51)*	*35(29)*	*107(131)*	*82(72)*	*51(39)*
			Behavioral Dyscontrol Scale		
5th	<2 (0)	0 (0)	– (–)	– (–)	– (–)
10th	7 (6)	<2 (3)	0 (0)	0 (0)	– (–)
25th	16 (16)	7 (15)	3 (3)	2 (3)	0 (0)
50th	17 (17)	17 (17)	12 (11)	7 (7)	3 (2)
75th	19 (19)	18 (18)	16 (16)	13 (13)	11 (11)
90th	– (–)	19 (19)	17 (17)	18 (18)	15 (14)
95th	– (–)	– (–)	19 (18)	19 (19)	17 (16)
N	*45(51)*	*35(29)*	*106(129)*	*78(67)*	*48(38)*

Table 5

Centiles by Age Cohort and Education Group

	Age Cohort (Weighted Score in Parentheses)									
	80–84		85–89		98–99		100–101		102+	
Education %ile	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**
Mini-Mental State Examination										
5th	1 (–)	17 (24)	– (4)	1 (4)	<1 (3)	1 (1)	0 (<1)	5 (6)	– (–)	5 (8)
10th	3 (1)	25 (25)	4 (5)	10 (24)	4 (9)	8 (8)	<1 (8)	9 (9)	– (–)	7 (11)
25th	14 (10)	27 (27)	7 (8)	26 (27)	15 (15)	15 (13)	8(11)	13 (15)	0 (0)	12 (13)
50th	26 (26)	28 (28)	12 (12)	27 (28)	20 (21)	21 (21)	14 (15)	20 (216)	3 (7)	17 (17)
75th	27 (27)	30 (29)	22 (24)	29 (29)	25 (25)	26 (26)	16 (20)	26 (28)	17 (15)	22 (23)
90th	28 (28)	– (30)	26 (26)	– (30)	27 (27)	29 (29)	23 (24)	29 (29)	21 (24)	25 (25)
95th	– (–)	–	–	30 (–)	28 (28)	30 (30)	27 (28)	30 (–)	25 (25)	29 (27)
N	*12(13)*	*33(39)*	*6(4)*	*29(25)*	*46(57)*	*61(75)*	*42(34)*	*39(37)*	*27(23)*	*22(14)*
Severe Impairment Battery										
5th	35 (–)	67 (95)	– (21)	17 (33)	<4 (24)	26 (26)	2 (6)	55 (59)	<1 (–)	42 (55)
10th	45 (35)	96 (96)	2 (75)	76 (87)	27 (37)	64 (57)	16 (53)	63 (76)	2 (0)	49 (65)
25th	91 (80)	99 (99)	53 (96)	98 (98)	82 (83)	89 (86)	65 (76)	84 (85)	4 (2)	77 (86)
50th	98 (98)	100 (100)	86 (98)	99 (99)	95 (95)	95 (94)	81 (88)	92 (95)	36 (38)	95 (95)
75th	99 (99)	–	98 (99)	100 (100)	98 (98)	99 (99)	94 (95)	98 (99)	87 (89)	98 (98)
90th	100	–	99 (100)	–	99 (99)	100 (100)	98 (98)	99 (100)	96 (96)	100 (100)
95th	–		–		100(100)	–	99 (100)	100 (–)	98 (99)	–
N	*12(13)*	*33(39)*	*6(4)*	*29(25)*	*45(56)*	*60(74)*	*42(34)*	*38(37)*	*27(23)*	*21(14)*
Behavioral Dyscontrol Scale										
5th	0 (–)	4 (6)	– (0)	0 (<1)	– (0)	–	– (–)	– (0)	– (–)	–
10th	2 (0)	14 (14)	0 (<1)	3 (4)	0 (<1)	0 (0)	0 (0)	0 (2)	– (–)	0 (0)
25th	8 (7)	17 (17)	2 (2)	15 (16)	5 (6)	4 (2)	1 (2)	4 (6)	– (–)	2 (1)
50th	16 (16)	18 (18)	5 (8)	17 (17)	11 (11)	12 (12)	5 (3)	12 (10)	0 (0)	4 (5)
75th	18 (17)	19 (19)	14 (15)	18 (19)	15 (15)	16 (16)	12 (8)	15 (16)	6 (13)	14 (13)
90th	– (18)	–	15 (–)	19 (–)	17 (16)	17 (17)	15 (18)	18 (18)	14 (16)	16 (15)
95th	–	–	– (–)	–	19 (18)	19 (18)	18 (19)	19 (–)	16 (17)	17 (16)

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	Age Cohort (Weighted Score in Parentheses)									
	80–84		**85–89**		**98–99**		**100–101**		**102+**	
Education %ile	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**	**< H.S.**	**H.S.+**
N	*12 (13)*	*33 (39)*	*6 (4)*	*29 (25)*	*45 (56)*	*59 (71)*	*40 (31)*	*36 (36)*	*24 (23)*	*21 (14)*

H.S., education level is below high school; H.S.+, education level at or above high school level.