

The Behavioural Assessment Scale: Norms for Factor-Based Subscales

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The Behavioural Assessment Scale (BAS) was developed to assess adaptive functioning in older persons with severe cognitive impairment. Previous research has demonstrated that BAS items can be rescored as 3 factor-based subscales entitled Daily Living Skills, Communication and Social Skills, and Problem Behavior, or as a global functioning aggregate. Normative information on these subscales is most helpful when based on a severely impaired sample because very little variation is present in an unimpaired population. In accordance with this goal, regression-predicted age- and mental-status-corrected percentile ranks are presented for these 4 subscales, and for the total score of the BAS.

Key words: Behavioural Assessment Scale, dementia, daily living skills, geriatric psychiatry, normative procedures

A major concern in neuropsychological assessment of persons with severe cognitive impairment is the insensitivity of mainstream testing instruments to between-patient differences in functional status. This assessment issue is pronounced for inpatient adult and geriatric neuropsychiatry, where patients suffer from acute or chronic mental disorders combined with brain injury, damage, or disease. This presents a challenge in documenting changes in the patients' condition, or assisting in treatment and discharge planning.

The *Echelle Comportement et Adaptation*, known in English as the Behavioural Assessment Scale (BAS; Ritchie & Ledesert, 1991), was designed for this pur-

pose of documenting between-patient differences in the functional status of older patients with moderate to severe dementia. The BAS is a clinician-administered rating scale that can be completed by a primary or secondary nurse. This rating scale is very straightforward, and specific training sessions are not necessary. A validation study, using an older Canadian sample, demonstrated that patients scoring zero on the Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) had BAS scores spread over a range from 16 to 119, indicating that the BAS is sensitive to varying levels of adaptive behavior deficits in persons with severe cognitive impairment (Iverson & Haley, 1997).

The BAS has advantages over other behavioral rating scales (e.g., the Nurse's Observation Scale for Geriatric Patients, Spiegel et al., 1991; the London Psychogeriatric Rating Scale, Hersch, Kral, & Palmer, 1978; and the Dementia Severity Rating Scale, Clark & Ewbank, 1996), such as providing more detailed behavioral information regarding activities of daily living and social communication.

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Although the 32-item scale was designed to measure five domains (language, social integration, occupation and orientation, physical independence, and mobility), psychometric investigations (Iverson & Woodward, in press; Woodward & Iverson, 1999) suggested that the BAS items can be conceptualized as drawing on three factor domains: Daily Living Skills, Communication and Social Skills, and Problem Behavior. Summation of specific items was recommended for computation of subscale scores reflecting these domains, and a global functioning aggregate. The BAS items, and their role in subscale computation, are listed in Table 1.

In the original article (Ritchie & Ledesert, 1991), the performance of some older controls was reported. However, because the BAS was designed for people

with known deficits in adaptive behavior, in nondemented, community-dwelling older persons there is a range restriction toward the upper end of the score range. For this reason, difficulties in the behavioral domains, as reflected by low BAS scores, are outside of what we would expect from well-functioning older adults. Thus, clinical use of these subscales within inpatient geriatric psychiatry would benefit from normative data on geriatric psychiatry inpatients with varying levels of functioning.

Also of importance is the influence of age and general mental status. If the age and mental status of a patient is known, and his or her score can be compared to the range expected for patients of comparable age and mental status, the abnormality of the score in question

Table 1. *Items Used for Subscale Computation*

Item	Daily Living Skills	Communication and Social Skills	Problem Behavior	Global Functioning
Oral Comprehension		XXX		XXX
Oral Expression		XXX		XXX
Nonverbal Expression		XXX		XXX
Recognition of Written Language		XXX		XXX
Writing Ability		XXX		XXX
Cooperativeness				XXX
Contact With Others		XXX		XXX
Awareness of Familiar Persons		XXX		XXX
Problem Daytime Behavior			XXX	
Problem Nighttime Behavior			XXX	
Activities				XXX
Tasks				XXX
Orientation				XXX
Dressing	XXX			XXX
Undressing	XXX			XXX
Putting on Shoes	XXX			XXX
Taking off Shoes	XXX			XXX
Going to Bed	XXX			XXX
Sleep Difficulties			XXX	
Use of Telephone				XXX
Use of Eating Utensils				XXX
Drinking				XXX
Urinary Continence	XXX			XXX
Fecal Continence	XXX			XXX
Independent Use of Toilets	XXX			XXX
Bathing	XXX			XXX
Washing Hands and Face	XXX			XXX
Dental Hygiene				
Shaving				
Walking	XXX			XXX
Posture and Gait				
Hand Control	XXX			XXX

Note: Items marked by XXX were summed to form subscales.

can be assessed with much more precision. To meet these needs, this investigation presents age- and mental-status-corrected percentile ranks for four subscales and the total score of the BAS on a clinical sample of geriatric psychiatry inpatients.

Method

Participants

The original sample consisted of 273 older inpatients from Riverview Hospital, a provincial psychiatric hospital in British Columbia, Canada. The Geriatric Psychiatry Division at Riverview Hospital is comprised of six programs: (a) Acute Assessment and Treatment, (b) Psychotic and Affective Disorders Treatment, (c) Aggressive Behavior Rehabilitation, (d) Behavior Stabilization, (e) Psychogeriatric Extensive Treatment, and (f) Community Reintegration. The majority of patients in the Geriatric Division have dementia; the etiologies of these dementias are diverse. These patients also have a full range of major psychiatric disorders, aggressive behavior, impulsivity, sexually inappropriate behavior, or combinations thereof. However, the specific diagnoses of these patients were not available in the database. Details regarding data collection and test administration are described elsewhere (Iverson & Woodward, in press; Woodward & Iverson, 1999).

Procedure

A subset of the sample ($n = 246$) was administered the MMSE (Folstein et al., 1975), and the normative tables were based on this subsample. This subsample consisted of 50% male and 50% female participants. All were over 60 years of age (range = 60–97 years), with a mean age of 76.0 years ($SD = 7.7$). The distribution of age in the sample was as follows: 25.6% were between 60 and 69, 44.3% were between 70 and 79, 24.8% were between 80 and 89, and 5.3% were between 90 and 97 years of age. The distribution of MMSE scores in the sample was as follows: 47.2% scored between 0 and 4, 10.6% scored between 5 and 9, 17.5% scored between 10 and 19, and 24.8% scored between 20 and 30. The BAS consists of 32 items, 23 of which are scaled and 9 of which are dichotomous items (i.e., scored as a behavior being present or absent). The maximum score is 163.

Normative method. The normative method used in this study provides regression-predicted percentile ranks (Iverson, Woodward, & Iverson, in press). This technique allowed the tabular presentation of the natural score distributions expected for a given age–MMSE combination (i.e., the data were not force-normalized; Allen & Yen, 1979, pp. 163–164). The basic normative procedure consisted of four steps. First, each score was regressed on age and MMSE using least-squares linear regression, and the unstandardized residuals were saved. Second, the resulting unstandardized beta coefficients for age and MMSE, and the constant, were used to calculate predicted scores (Pedhazur, 1982, p. 17) for the age–MMSE combination in question (e.g., 75 years of age and MMSE = 15). That is, the predicted point score for a given age and MMSE level was calculated using the derived regression equation. Third, the scores that would comprise the distribution of normative scores for a given age–MMSE combination were computed as the sum of (a) the predicted score for the age in question, and (b) the unstandardized residual scores saved from the aforementioned regression analysis. Fourth, the frequency distribution of the scores mentioned in the third step was computed, yielding percentile ranks (i.e., regression-predicted percentile ranks) for the age–MMSE combination in question.

Results

The linear regression results when each subscale score was regressed on age and MMSE are listed in Table 2. Because neither age nor MMSE was a significant predictor of problem behavior, the frequency distribution for this subscale presented in Table 3 can be used for all older neuropsychiatric inpatients. Age and MMSE score were significant predictors of Daily Living Skills, Global Functioning, and the BAS total score. Therefore, normative tables for ages 60 through 69, 70 through 79, and 80 through 89 were broken down by MMSE scores of 0 to 4, 5 to 9, 10 to 19, and 20 to 30, and are provided in the Appendix.

Although age was not a significant predictor of Communication and Social Skills over and above MMSE score, for simplicity of presentation this subscale was subjected to the same corrections as Daily Living Skills, Global Functioning, and Total Score. The table in the Appendix are used by locating the patient's raw score in the column labeled Raw, and reading the percentile in the column corresponding to the subscale of interest. Higher raw scores correspond to

Table 2. Regression Statistics for Each Subscale and Total Score, With Age and MMSE as Predictor Variables

	<i>R</i> ²	<i>F</i> Value	Age Beta	Age Beta <i>t</i> Value	MMSE Beta	MMSE Beta <i>t</i> Value
Daily Living Skills	.62	201.59**	−0.17	−4.02**	0.72	17.51**
Communication and Social Skills	.64	211.16**	0.01	−0.35	0.80	19.67**
Problem Behavior	.01	1.35	−0.09	−1.29	0.04	0.58
Global Functioning	.69	270.10**	−0.11	−3.04*	0.79	21.01**
Total Score	.68	260.67**	−0.12	−3.15*	0.78	20.57**

Note: For all analyses, *df*₁ = 2, *df*₂ = 243. Reported betas are standardized.

p* < .01. *p* < .001.

Table 3. Regression-Predicted Percentile Ranks for the Problem Behavior Subscale

Raw Score	Problem Behavior
0–3	<1
4	1
5	2
6	3
7	3
8	5
9	9
10	12
11	19
12	27
13	33
14	40
15	51
16	60
17	70
18	81
19	>99

Note: High scores on this subscale convey decreased problem behaviors. For example, a patient who is not disruptive during the day and sleeps well at night would score in the higher percentile ranges on this subscale.

higher percentiles, which convey better performance in that area.

Discussion

The BAS was designed to measure adaptive functioning in older persons with dementia. In the original French study (Ritchie & Ledesert, 1991), 32 older patients without dementia obtained average total scores of 129.8 (*SD* = 20.4, range = 110–150). Thus, there is a

pronounced ceiling effect on this test for nondemented older participants. This study provided clinical normative data for geriatric psychiatric inpatients. The norms are corrected for age and degree of cognitive impairment (the latter measured by the MMSE). The norms are based on factor scores, computed by summing the items presented in Table 1. These clinical normative tables are helpful for documenting between-patient differences in functional status by avoiding (a) the floor effects encountered by mainstream cognitive testing instruments, and (b) the ceiling effects encountered when an unimpaired population is used to provide normative information.

It is of interest to note that although age and MMSE explain unique variance in Daily Living Skills (and therefore also in the Global Functioning and Total score), only MMSE (not age) explains unique variance in Communication and Social Skills. From this it can be concluded that although age-related processes over and above declining mental status are associated with decline in Daily Living Skills, decline in Communication and Social Skills can be explained by mental status decline only. It is also important to note that MMSE and age share only 9% of their variance, $r(244) = -0.31, p < .01$, suggesting that the severity of cognitive impairment is relatively independent of age in this sample.

The following case examples illustrate the use of the normative tables. Take a 69-year-old female psychiatric inpatient who obtains a score of 11 on the MMSE and factor subscale scores of 3, 12, 15, and 24 on the Daily Living Skills, Communication and Social Skills, Problem Behavior, and Global Functioning scales, respectively. Obviously, this woman has serious cognitive and adaptive behavior problems as compared to older persons in the general population. By referring to the table for 60- to 69-year-olds who scored between 10 and 19 on the MMSE, the specific patient can be compared to patients with similar age and mental status characteristics. Her subscale factor scores fell at the following percentile ranks: 1%, 9% (Table A3), 51%

(from Table 3), and 1% (Table A3). These scores indicate that her Daily Living Skills and Global Functioning scores were highly abnormal as compared to the clinical normative patients (i.e., below the 2nd percentile). Her Communication and Social Skills were atypical (9th percentile), as compared to similar patients, and her Problem Behaviors were typical of these patients (i.e., average for the patient group).

A second example is of a 72-year-old man on an inpatient psychiatry unit who obtained a MMSE score of 6 and BAS factor subscale scores of 29, 5, 18, and 46, on Daily Living Skills, Communication and Social Skills, Problem Behavior, and Global Functioning, respectively. Referring to the table for 70- to 79-year-olds with MMSE scores between 5 and 9, the clinician can see that his Daily Living Skills score was above average (i.e., 72nd percentile) for the patient group. However, his Communication and Social Skills score fell at the 5th percentile, indicating that 95% of the patient group performed better in the area. His Problem Behavior score was at the 81st percentile, indicating that he had fewer problem behaviors than the majority of patients in his comparison group. His Global Functioning score fell at the 48th percentile, which is average for the patient group.

In conclusion, the BAS normative tables will allow the clinician to interpret an older psychiatric inpatient's adaptive functioning within a clinical perspective. That is, a specific patient's Communication and Social Skills and Daily Living Skills score can be compared to that expected for older inpatients of similar age and degree of cognitive impairment.

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Appendix

For all tables, MMSE = Mini Mental State Exam; DLS = Daily Living Skills; Communication = Communication and Social Skills; Global = Global Functioning. The maximum scores possible are as follows: DLS = 64, Communication = 31, Global = 131, and Total = 163.

Table A1. Norms for 60- to 69-Year-Olds With MMSE Scores Between 0 and 4

Raw	DLS	Communication	Global	Total
0	7	4	4	1
1	7	9	4	1
2	9	15	4	1
3	12	19	5	1
4	14	23	5	1
5	15	26	5	1
6	17	34	6	1
7	20	40	7	1
8	22	46	7	2
9	26	54	8	2
10	27	59	9	2
11	33	65	11	2
12	37	71	11	2
13	40	76	13	2
14	43	82	15	2
15	49	85	15	3
16	53	89	17	3
17	55	91	21	3
18	58	92	22	3
19	59	93	24	4
20	62	95	26	4
21	63	96	27	4
22	65	98	29	4
23	68	99	30	5
24	72	>99	30	5
25	72		32	6
26	74		33	7
27	76		36	7
28	77		38	7
29	78		41	7
30	78		43	7
31	80		45	8
32	80		46	9
33	81		48	10
34	83		48	11
35	86		50	12
36	86		52	14
37	89		53	14
38	90		55	15
39	90		58	16
40	90		60	17

Raw	DLS	Communication	Global	Total
41	90		61	19
42	93		64	20
43	93		66	21
44	93		67	24
45	93		70	26
46	95		70	27
47	95		71	29
48	95		73	30
49	96		74	33
50	96		74	35
51	97		75	38
52	97		76	39
53	97		76	43
54	97		78	43
55	98		78	44
56	98		79	47
57	98		80	50
58	99		81	52
59	99		82	54
60	99		84	56
61	99		85	57
62	99		86	59
63	99		87	61
64	>99		88	62
65			88	64
66			88	65
67			89	67
68			89	69
69			90	70
70			91	70
71			91	70
72			92	73
73			92	74
74			93	74
75			93	75
76			95	76
77			95	77
78			96	79
79			96	80
80			96	80
81			96	80
82			96	81
83			96	83
84			97	84
85			97	84
86			97	84
87			98	85
88			98	86
89			98	86
90			98	86
91			98	87
92			98	88
93			98	89

(continued)

Table A1. (Continued)

Raw	DLS	Communication	Global	Total
94			98	90
95			98	90
96			98	91
97			98	91
98			98	92
99			99	93
100			99	93
101			99	94
102			99	94
103			99	95
104			99	96
105			99	96
106			99	96
107			>99	96
108				97
109				97
110				97
111				97
112				97
113				98
114				98
115				98
116				98
117				98
118				98
119				98
120				98
121				98
122				98
123				98
124				98
125				98
126				99
127				99
128				99
129				99
130				99
131				99
132				99
133				99
134				99
135–163				>99

Note: Regression-predicted percentile ranks based on a 65-year-old with an MMSE score of 1.

Table A2. Norms for 60- to 69-Year-Olds With MMSE Scores Between 5 and 9

Raw	DLS	Communication	Global	Total
0	2	1	1	
1	2	1	1	
2	3	1	1	
3	3	2	1	
4	4	2	1	
5	4	6	1	
6	4	13	1	
7	5	17	2	
8	5	22	2	
9	6	24	2	<1
10	6	30	2	1
11	7	36	2	1
12	9	43	2	1
13	10	50	2	1
14	12	57	3	1
15	14	61	3	1
16	15	67	3	1
17	19	73	4	1
18	21	78	4	1
19	26	83	4	1
20	27	85	4	1
21	31	90	4	1
22	35	91	4	1
23	37	92	5	1
24	41	94	5	1
25	46	96	6	1
26	51	96	7	1
27	54	98	7	1
28	56	99	7	2
29	59	>99	9	2
30	61		11	2
31	63		11	2
32	64		12	2
33	66		14	2
34	69		15	3
35	72		17	3
36	73		20	3
37	75		22	3
38	76		24	3
39	78		25	4
40	78		26	4
41	79		29	4
42	80		29	4
43	81		30	5
44	82		32	5
45	84		33	6
46	86		36	7
47	87		37	7
48	89		40	7
49	90		41	7
50	90		45	7

(continued)

BAS NORMS

Table A2. (Continued)

Raw	DLS	Communication	Global	Total
51	90		46	8
52	91		48	9
53	93		48	10
54	93		50	11
55	93		52	12
56	95		53	14
57	95		55	14
58	95		57	15
59	96		60	16
60	96		61	18
61	96		64	19
62	97		65	20
63	97		67	22
64	>99		68	24
65			70	26
66			71	28
67			72	29
68			74	30
69			74	33
70			75	36
71			76	39
72			76	40
73			78	43
74			78	43
75			79	44
76			80	48
77			81	50
78			82	52
79			84	55
80			85	56
81			86	58
82			87	60
83			88	61
84			88	63
85			88	64
86			89	66
87			89	67
88			90	69
89			91	70
90			91	70
91			92	71
92			92	73
93			93	74
94			93	74
95			95	75
96			95	76
97			95	78
98			96	79
99			96	80
100			96	80
101			96	81
102			96	82
103			97	83

Raw	DLS	Communication	Global	Total
104			97	84
105			97	84
106			98	84
107			98	85
108			98	86
109			98	86
110			98	86
111			98	87
112			98	88
113			98	89
114			98	90
115			98	90
116			98	91
117			98	92
118			98	93
119			99	93
120			99	93
121			99	94
122			99	95
123			99	95
124			99	96
125			99	96
126			>99	96
127				97
128				97
129				97
130				97
131				97
132				98
133				98
134				98
135				98
136				98
137				98
138				98
139				98
140				98
141				98
142				98
143				98
144				98
145				98
146				99
147				99
148				99
149				99
150				99
151				99
152				99
153				99
154				99
155-163				>99

Note: Regression-predicted percentile ranks based on a 65-year-old with an MMSE score of 7.

Table A3. Norms for 60- to 69-Year-Olds With MMSE Scores Between 10 and 19

Raw	DLS	Communication	Global	Total
0	1			
1	1	<1		
2	1	1		
3	1	1		
4	1	1		
5	1	1		
6	1	1		
7	1	1		
8	1	1		
9	1	1		
10	1	2		
11	1	4		
12	1	9		
13	1	15		
14	2	19		
15	2	23		
16	3	26		
17	3	34		
18	4	40	<1	
19	4	46	1	
20	4	54	1	
21	5	59	1	
22	5	65	1	
23	6	71	1	
24	6	76	1	
25	7	82	1	
26	7	85	1	
27	10	89	1	
28	12	91	1	
29	14	92	1	
30	15	93	1	
31	19	>99	1	
32	21		1	
33	26		2	
34	27		2	
35	30		2	
36	34		2	<1
37	37		2	1
38	41		2	1
39	46		3	1
40	50		3	1
41	54		3	1
42	56		3	1
43	59		4	1
44	60		4	1
45	63		4	1
46	64		4	1
47	66		4	1
48	69		5	1
49	72		5	1

Raw	DLS	Communication	Global	Total
50	73		5	1
51	75		6	1
52	76		7	1
53	77		7	1
54	78		8	2
55	79		9	2
56	80		11	2
57	81		12	2
58	82		14	2
59	84		15	2
60	86		16	2
61	87		17	3
62	89		21	3
63	90		22	3
64	>99		25	3
65			26	4
66			28	4
67			29	4
68			30	4
69			31	5
70			32	5
71			35	6
72			36	7
73			38	7
74			41	7
75			43	7
76			46	7
77			46	8
78			48	9
79			50	10
80			50	10
81			53	12
82			54	14
83			57	14
84			59	15
85			61	16
86			62	17
87			64	19
88			66	20
89			67	21
90			70	23
91			70	26
92			72	27
93			73	29
94			74	30
95			75	32
96			75	35
97			76	37
98			76	39
99			78	43
100			78	43
101			79	44
102			80	46

(continued)

BAS NORMS

Table A3. (Continued)

Raw	DLS	Communication	Global	Total
103			81	49
104			83	52
105			84	54
106			86	56
107			85	57
108			85	59
109			86	61
110			87	62
111			88	64
112			89	65
113			89	67
114			90	69
115			91	70
116			92	70
117			92	70
118			93	73
119			93	74
120			93	74
121			95	75
122			95	76
123			96	77
124			96	78
125			96	80
126			96	80
127			96	80
128			97	81
129			97	83
130			97	83
131			>99	84
132				84
133				85
134				86
135				86
136				86
137				87
138				88
139				89
140				90
141				90
142				90
143				91
144				92
145				93
146				93
147				94
148				94
149				95
150				96
151				96
152				96
153				96

Raw	DLS	Communication	Global	Total
154				97
155				97
156				97
157				97
158				97
159				98
160				98
161				98
162				98
163				>99

Note: Regression-predicted percentile ranks based on a 65-year-old with an MMSE score of 15.

Table A4. Norms for 60- to 69-Year-Olds With MMSE Scores Between 20 and 30

Raw	DLS	Communication	Global	Total
0				
1				
2				
3				
4				
5				
6				
7				
8		<1		
9		1		
10	<1	1		
11	1	1		
12	1	1		
13	1	1		
14	1	1		
15	1	1		
16	1	1		
17	1	2		
18	1	3		
19	1	8		
20	1	14		
21	1	18		
22	1	23		
23	1	26		
24	1	33		
25	1	39		
26	1	46		
27	1	54		
28	1	59		
29	1	64		
30	2	70		
31	2	>99		
32	3			
33	3			
34	4			
35	4			
36	4			
37	5			
38	6			
39	6			
40	6			
41	7			
42	9			
43	10			
44	12			
45	14			
46	15		<1	
47	19		1	
48	21		1	
49	26		1	

Raw	DLS	Communication	Global	Total
50	27		1	
51	31		1	
52	35		1	
53	38		1	
54	41		1	
55	47		1	
56	52		1	
57	54		1	
58	56		1	
59	59		1	
60	61		1	
61	63		2	
62	65		2	
63	67		2	
64	>99		2	
65			2	<1
66			2	1
67			2	1
68			3	1
69			3	1
70			3	1
71			3	1
72			4	1
73			4	1
74			4	1
75			4	1
76			4	1
77			5	1
78			5	1
79			6	1
80			6	1
81			7	1
82			7	1
83			8	1
84			10	2
85			11	2
86			12	2
87			14	2
88			15	2
89			16	2
90			19	3
91			21	3
92			23	3
93			25	3
94			26	3
95			28	4
96			29	4
97			30	4
98			31	4
99			33	5
100			36	5
101			37	6
102			38	7

(continued)

BAS NORMS

Table A4. (Continued)

Raw	DLS	Communication	Global	Total
103			41	7
104			44	7
105			46	7
106			47	7
107			52	8
108			53	9
109			54	10
110			56	11
111			57	12
112			58	14
113			59	14
114			61	15
115			63	16
116			65	18
117			66	19
118			68	20
119			70	22
120			71	24
121			72	26
122			73	27
123			74	29
124			75	30
125			76	33
126			76	36
127			77	38
128			78	40
129			79	43
130			80	43
131			>99	44
132				48
133				50
134				52
135				55
136				56
137				58
138				60
139				61
140				63
141				64
142				65
143				67
144				69
145				70
146				70
147				70
148				73
149				74
150				74
151				75
152				76
153				77
154				79

Raw	DLS	Communication	Global	Total
155				80
156				80
157				80
158				82
159				83
160				84
161				84
162				84
163				>99

Note: Regression-predicted percentile ranks based on a 65-year-old with an MMSE score of 24.

Table A5. Norms for 70- to 79-Year-Olds With MMSE Scores Between 0 and 4

Raw	DLS	Communication	Global	Total
0	15	2	6	1
1	19	7	7	2
2	21	13	7	2
3	26	18	8	2
4	27	22	9	2
5	31	25	11	2
6	35	33	12	2
7	37	37	14	2
8	41	45	15	3
9	47	53	16	3
10	51	59	17	3
11	54	64	21	3
12	56	70	22	4
13	59	76	25	4
14	61	80	26	4
15	63	84	28	4
16	64	87	29	5
17	66	90	30	5
18	69	92	31	6
19	72	93	32	7
20	73	95	35	7
21	75	96	36	7
22	76	97	38	7
23	78	98	41	7
24	78	99	43	8
25	79	>99	46	9
26	80		46	10
27	81		48	10
28	82		50	12
29	85		50	14
30	86		53	14
31	87		54	15
32	89		57	16
33	90		59	17
34	90		61	19
35	90		62	20
36	91		64	21
37	93		66	23
38	93		67	26
39	93		70	27
40	95		70	29
41	95		72	30
42	95		73	32
43	96		74	35
44	96		75	38
45	96		75	39
46	97		76	43
47	97		76	43
48	97		78	44
49	97		78	47

Raw	DLS	Communication	Global	Total
50	98		79	49
51	98		80	52
52	98		81	54
53	99		83	56
54	99		84	57
55	99		86	59
56	99		87	61
57	99		87	62
58	99		88	64
59	99		88	65
60	99		89	67
61	100		89	69
62	>99		89	70
63	>99		90	70
64	>99		91	70
65			92	73
66			92	74
67			93	74
68			93	75
69			93	76
70			95	77
71			95	78
72			96	80
73			96	80
74			96	80
75			96	81
76			96	83
77			96	83
78			97	84
79			97	84
80			97	85
81			98	86
82			98	86
83			98	86
84			98	87
85			98	88
86			98	89
87			98	90
88			98	90
89			98	90
90			98	91
91			98	92
92			98	93
93			99	93
94			99	94
95			99	94
96			99	95
97			99	96
98			99	96
99			99	96
100			99	96
101			>99	97
102				97

(continued)

BAS NORMS

Table A5. (Continued)

Raw	DLS	Communication	Global	Total
103				97
104				97
105				97
106				98
107				98
108				98
109				98
110				98
111				98
112				98
113				98
114				98
115				98
116				98
117				98
118				98
119				99
120				99
121				99
122				99
123				99
124				99
125				99
126				99
127				99
128-163				>99

Note: Regression-predicted percentile ranks based on a 75-year-old with an MMSE score of 1.

Table A6. Norms for 70- to 79-year-olds With MMSE Scores Between 5 and 9

Raw	DLS	Communication	Global	Total
0	4	1	1	
1	5	1	2	
2	5	1	2	
3	6	2	2	<1
4	6	2	2	1
5	6	5	2	1
6	7	9	2	1
7	9	16	3	1
8	12	20	3	1
9	14	23	3	1
10	15	27	3	1
11	17	34	4	1
12	20	41	4	1
13	22	48	4	1
14	26	54	4	1
15	27	60	4	1
16	33	65	5	1
17	36	72	5	1
18	40	77	5	1
19	43	82	6	1
20	49	85	7	1
21	53	89	7	2
22	55	91	8	2
23	58	92	9	2
24	59	93	11	2
25	62	95	11	2
26	63	96	13	2
27	65	98	15	3
28	68	99	15	3
29	72	>99	17	3
30	72		21	3
31	74		22	3
32	76		25	4
33	77		26	4
34	78		27	4
35	78		29	4
36	80		30	5
37	80		30	5
38	81		32	6
39	83		34	7
40	86		36	7
41	86		38	7
42	89		41	7
43	90		43	7
44	90		46	8
45	90		46	9
46	90		48	10
47	93		49	11
48	93		50	12
49	93		52	14

(continued)

Table A6. (Continued)

Raw	DLS	Communication	Global	Total
50	93		53	14
51	95		57	15
52	95		58	16
53	95		60	18
54	96		61	19
55	96		64	20
56	96		66	22
57	97		67	24
58	97		70	26
59	97		70	27
60	98		71	29
61	98		73	30
62	98		74	33
63	99		75	35
64	>99		75	38
65			76	40
66			76	43
67			78	43
68			78	44
69			79	47
70			80	50
71			81	52
72			82	54
73			84	56
74			85	58
75			87	60
76			87	61
77			88	63
78			88	64
79			89	65
80			89	67
81			89	69
82			90	70
83			91	70
84			92	70
85			92	73
86			93	74
87			93	74
88			93	75
89			95	76
90			95	77
91			96	79
92			96	80
93			96	80
94			96	80
95			96	82
96			96	83
97			97	84
98			97	84
99			97	84
100			98	85
101			98	86

Raw	DLS	Communication	Global	Total
102			98	86
103			98	86
104			98	87
105			98	88
106			98	89
107			99	90
108			99	90
109			99	91
110			99	91
111			99	93
112			99	93
113			99	93
114			99	94
115			99	94
116			99	95
117			99	96
118			99	96
119			99	96
120			>99	97
121				97
122				97
123				97
124				97
125				98
126				98
127				98
128				98
129				98
130				98
131				98
132				98
133				98
134				98
135				98
136				98
137				98
138				98
139				99
140				99
141				99
142				99
143				99
144				99
145				99
146				99
147				99
148–163				>99

Note: Regression-predicted percentile ranks based on a 75-year-old with an MMSE score of 7.

BAS NORMS

Table A7. Norms for 70- to 79-Year-Olds With MMSE Scores Between 10 and 19

Raw	DLS	Communication	Global	Total
0	1			
1	1	<1		
2	1	1		
3	1	1		
4	1	1		
5	1	1		
6	1	1		
7	1	1		
8	2	1		
9	2	1		
10	3	2		
11	3	2	<1	
12	3	7	1	
13	4	13	1	
14	4	18	1	
15	5	22	1	
16	5	25	1	
17	6	32	1	
18	6	37	1	
19	6	45	1	
20	7	53	1	
21	9	59	1	
22	12	64	1	
23	14	70	1	
24	15	76	1	
25	17	80	1	
26	20	84	2	
27	22	87	2	
28	26	90	2	
29	27	92	2	<1
30	33	93	2	1
31	35	>99	2	1
32	40		2	1
33	43		3	1
34	49		3	1
35	53		3	1
36	55		3	1
37	58		4	1
38	59		4	1
39	62		4	1
40	63		4	1
41	65		4	1
42	68		5	1
43	72		5	1
44	72		6	1
45	74		6	1
46	76		7	1
47	76		7	2
48	78		8	2
49	78		10	2

Raw	DLS	Communication	Global	Total
50	80		11	2
51	80		12	2
52	81		14	2
53	83		15	2
54	86		16	3
55	86		19	3
56	88		21	3
57	89		23	3
58	90		25	4
59	90		26	4
60	90		28	4
61	93		29	4
62	93		30	5
63	93		31	5
64	>99		33	6
65			36	7
66			37	7
67			38	7
68			41	7
69			44	7
70			46	8
71			47	9
72			48	9
73			50	10
74			51	12
75			53	13
76			54	14
77			57	14
78			59	16
79			61	17
80			63	19
81			65	20
82			66	20
83			68	23
84			70	25
85			71	27
86			72	29
87			73	30
88			74	31
89			75	34
90			76	37
91			76	39
92			76	42
93			78	43
94			79	44
95			80	46
96			81	49
97			81	51
98			83	54
99			84	55
100			86	57
101			87	59
102			88	60

(continued)

Table A7. (Continued)

Raw	DLS	Communication	Global	Total
103			88	62
104			88	63
105			89	65
106			89	67
107			90	68
108			91	70
109			91	70
110			92	70
111			92	72
112			93	74
113			93	74
114			95	75
115			95	76
116			95	77
117			96	78
118			96	79
119			96	80
120			96	80
121			96	81
122			97	83
123			97	83
124			97	84
125			97	84
126			98	85
127			98	86
128			98	86
129			98	86
130			98	87
131			>99	88
132				89
133				89
134				90
135				90
136				91
137				92
138				93
139				93
140				93
141				94
142				95
143				96
144				96
145				96
146				96
147				97
148				97
149				97
150				97
151				97
152				98
153				98
154				98

Raw	DLS	Communication	Global	Total
155				98
156				98
157				98
158				98
159				98
160				98
161				98
162				98
163				>99

Note: Regression-predicted percentile ranks based on a 75-year-old with an MMSE score of 15.

BAS NORMS

Table A8. Norms for 70- to 79-Year-Olds With MMSE Scores Between 20 and 30

Raw	DLS	Communication	Global	Total
0				
1				
2				
3				
4				
5	<1			
6	1			
7	1			
8	1			
9	1	<1		
10	1	1		
11	1	1		
12	1	1		
13	1	1		
14	1	1		
15	1	1		
16	1	1		
17	1	2		
18	1	2		
19	1	7		
20	1	13		
21	1	18		
22	1	22		
23	1	25		
24	2	32		
25	2	36		
26	3	45		
27	3	52		
28	4	58		
29	4	63		
30	4	69		
31	5	>99		
32	5			
33	6			
34	6			
35	7			
36	7			
37	10			
38	12			
39	14			
40	15		<1	
41	18		1	
42	20		1	
43	23		1	
44	27		1	
45	28		1	
46	33		1	
47	37		1	
48	40		1	
49	43		1	

Raw	DLS	Communication	Global	Total
50	49		1	
51	53		1	
52	55		1	
53	58		1	
54	60		1	
55	62		2	
56	63		2	
57	66		2	
58	68		2	
59	72		2	<1
60	73		2	1
61	74		2	1
62	76		3	1
63	77		3	1
64	>99		3	1
65			4	1
66			4	1
67			4	1
68			4	1
69			4	1
70			5	1
71			5	1
72			5	1
73			6	1
74			7	1
75			7	1
76			7	1
77			9	2
78			11	2
79			11	2
80			13	2
81			14	2
82			15	2
83			17	2
84			20	3
85			22	3
86			24	3
87			25	3
88			26	4
89			29	4
90			29	4
91			30	4
92			32	5
93			33	5
94			36	6
95			37	7
96			40	7
97			42	7
98			45	7
99			46	7
100			48	8
101			48	9
102			50	10

(continued)

Table A8. (Continued)

Raw	DLS	Communication	Global	Total
103			52	11
104			53	12
105			55	14
106			57	14
107			68	15
108			68	16
109			69	18
110			69	19
111			70	20
112			70	22
113			70	24
114			71	26
115			73	27
116			74	29
117			74	30
118			75	33
119			76	35
120			76	38
121			78	39
122			78	43
123			79	43
124			80	44
125			81	47
126			82	50
127			84	52
128			85	54
129			86	56
130			87	57
131			>99	60
132				61
133				63
134				64
135				65
136				67
137				69
138				70
139				70
140				70
141				73
142				74
143				74
144				75
145				76
146				77
147				79
148				80
149				80
150				80
151				82
152				83
153				84
154				84

Raw	DLS	Communication	Global	Total
155				84
156				85
157				86
158				86
159				86
160				87
161				88
162				89
163				>99

Note: Regression-predicted percentile ranks based on a 75-year-old with an MMSE score of 24.

BAS NORMS

Table A9. Norms for 80- to 89-Year-Olds With MMSE Scores Between 0 and 4

Raw	DLS	Communication	Global	Total
0	33	2	12	2
1	37	7	14	3
2	40	13	15	3
3	43	18	16	3
4	49	22	18	3
5	53	25	21	4
6	55	31	23	4
7	58	36	25	4
8	59	44	26	4
9	62	52	28	5
10	63	58	29	5
11	65	62	30	6
12	68	68	31	7
13	72	74	33	7
14	72	80	35	7
15	74	84	37	7
16	76	86	38	7
17	77	90	41	8
18	78	91	44	9
19	78	93	46	9
20	80	94	47	10
21	80	96	48	12
22	81	97	50	13
23	83	98	51	14
24	86	99	53	15
25	86	>99	54	16
26	89		57	17
27	90		59	19
28	90		61	20
29	90		63	21
30	90		65	23
31	93		66	25
32	93		67	27
33	93		70	29
34	93		71	30
35	95		72	31
36	95		73	35
37	95		74	37
38	96		75	39
39	96		76	42
40	97		76	43
41	97		76	44
42	97		78	46
43	97		78	49
44	98		80	51
45	98		80	54
46	98		81	56
47	99		83	57
48	99		84	59
49	99		86	60

Raw	DLS	Communication	Global	Total
50	99		87	62
51	99		88	63
52	99		88	65
53	99		88	67
54	99		89	68
55	99		89	70
56	>99		90	70
57	>99		91	70
58	>99		91	72
59	>99		92	74
60	>99		92	74
61	>99		93	75
62	>99		93	76
63	>99		95	77
64	>99		95	78
65			95	79
66			96	80
67			96	80
68			96	81
69			96	83
70			96	83
71			97	84
72			97	84
73			97	85
74			97	86
75			98	86
76			98	86
77			98	87
78			98	88
79			98	89
80			98	90
81			98	90
82			98	90
83			98	91
84			98	92
85			98	93
86			98	93
87			99	93
88			99	94
89			99	95
90			99	96
91			99	96
92			99	96
93			99	96
94			>99	97
95				97
96				97
97				97
98				97
99				98
100				98
101				98
102				98

(continued)

Table A9. (Continued)

Raw	DLS	Communication	Global	Total
103				98
104				98
105				98
106				98
107				98
108				98
109				98
110				98
111				98
112				98
113				99
114				99
115				99
116				99
117				99
118				99
119				99
120				99
121-163				>99

Note: Regression-predicted percentile ranks based on an 85-year-old with an MMSE score of 1.

Table A10. Norms for 80- to 89-Year-Olds With MMSE Scores Between 5 and 9

Raw	DLS	Communication	Global	Total
0	7	1	2	1
1	8	1	3	1
2	10	1	3	1
3	12	1	3	1
4	14	2	3	1
5	15	3	4	1
6	19	8	4	1
7	21	14	4	1
8	26	18	4	1
9	27	23	4	1
10	31	26	5	1
11	34	33	5	1
12	37	39	6	1
13	41	46	6	1
14	46	53	7	2
15	51	59	7	2
16	54	64	8	2
17	56	70	9	2
18	59	76	11	2
19	60	81	12	2
20	63	84	14	2
21	64	88	15	3
22	66	91	16	3
23	69	92	18	3
24	72	93	21	3
25	73	95	22	4
26	75	96	25	4
27	76	98	26	4
28	78	99	28	4
29	78	99	29	5
30	79	>99	30	5
31	80		31	6
32	81		33	7
33	82		35	7
34	84		37	7
35	86		38	7
36	87		41	7
37	89		43	8
38	90		46	9
39	90		46	10
40	90		48	11
41	91		50	12
42	93		51	14
43	93		53	14
44	93		54	15
45	95		57	16
46	95		59	17
47	95		61	19
48	96		63	20
49	96		64	21

(continued)

BAS NORMS

Table A10. (Continued)

Raw	DLS	Communication	Global	Total
50	96		66	24
51	97		67	26
52	97		70	27
53	97		71	29
54	97		72	30
55	98		73	33
56	98		74	35
57	98		75	38
58	99		75	39
59	99		76	43
60	99		76	43
61	99		78	44
62	99		78	47
63	99		79	50
64	>99		80	52
65			81	54
66			83	56
67			84	57
68			86	59
69			87	61
70			88	62
71			88	64
72			88	65
73			89	67
74			89	69
75			89	70
76			91	70
77			91	70
78			92	73
79			92	74
80			93	74
81			93	75
82			94	76
83			95	77
84			95	78
85			96	80
86			96	80
87			96	80
88			96	81
89			96	83
90			97	83
91			97	84
92			97	84
93			97	85
94			98	86
95			98	86
96			98	86
97			98	87
98			98	88
99			98	89
100			98	90

Raw	DLS	Communication	Global	Total
101			98	90
102			98	91
103			98	91
104			98	92
105			98	93
106			99	93
107			99	94
108			99	94
109			99	95
110			99	96
111			99	96
112			99	96
113			99	96
114			>99	97
115				97
116				97
117				97
118				97
119				98
120				98
121				98
122				98
123				98
124				98
125				98
126				98
127				98
128				98
129				98
130				98
131				98
132				99
133				99
134				99
135				99
136				99
137				99
138				99
139				99
140				99
141-163				>99

Note Regression-predicted percentile ranks based on an 85-year-old with an MMSE score of 7.

Table A11. Norms for 80- to 89-Year-Olds With MMSE Scores Between 10 and 19

Raw	DLS	Communication	Global	Total
0	1			
1	1			
2	1	<1		
3	2	1		
4	2	1		
5	3	1	<1	
6	3	1	1	
7	4	1	1	
8	4	1	1	
9	4	1	1	
10	5	2	1	
11	5	2	1	
12	6	7	1	
13	6	13	1	
14	7	18	1	
15	7	22	1	
16	10	25	1	
17	12	31	1	
18	14	36	1	
19	15	44	1	
20	18	52	2	
21	20	58	2	
22	25	62	2	<1
23	27	68	2	1
24	30	74	2	1
25	34	80	2	1
26	37	84	2	1
27	41	86	3	1
28	46	90	3	1
29	50	91	3	1
30	54	93	4	1
31	56	>99	4	1
32	59		4	1
33	60		4	1
34	63		4	1
35	64		5	1
36	66		5	1
37	69		5	1
38	72		6	1
39	73		7	1
40	75		7	1
41	76		7	2
42	77		9	2
43	78		11	2
44	78		11	2
45	80		13	2
46	81		14	2
47	82		15	3
48	84		17	3
49	86		20	3

Raw	DLS	Communication	Global	Total
50	87		22	3
51	89		24	4
52	90		25	4
53	90		26	4
54	90		29	4
55	91		29	4
56	93		30	5
57	93		32	6
58	93		33	7
59	95		36	7
60	95		37	7
61	95		40	7
62	96		42	7
63	96		45	8
64	>99		46	9
65			48	9
66			48	10
67			50	12
68			52	13
69			53	14
70			55	14
71			57	16
72			60	17
73			61	19
74			64	20
75			65	20
76			67	22
77			69	25
78			70	27
79			71	28
80			73	29
81			74	31
82			74	34
83			75	37
84			76	39
85			76	41
86			78	43
87			78	44
88			79	45
89			80	48
90			81	50
91			82	54
92			84	55
93			85	57
94			86	59
95			87	60
96			88	61
97			88	63
98			88	65
99			89	67
100			89	68
101			90	69
102			91	70

(continued)

BAS NORMS

Table A11. (Continued)

Raw	DLS	Communication	Global	Total
103			91	70
104			92	72
105			92	74
106			93	74
107			96	75
108			96	76
109			96	77
110			96	78
111			96	79
112			96	80
113			96	80
114			96	81
115			96	83
116			97	83
117			97	84
118			97	84
119			98	85
120			98	86
121			98	86
122			98	86
123			98	87
124			98	88
125			98	89
126			98	89
127			98	90
128			98	90
129			98	91
130			98	92
131			>99	93
132				93
133				93
134				94
135				95
136				96
137				96
138				96
139				96
140				97
141				97
142				97
143				97
144				97
145				98
146				98
147				98
148				98
149				98
150				98
151				98
152				98
153				98

Raw	DLS	Communication	Global	Total
154				98
155				98
156				98
157				98
158				98
159				99
160				99
161				99
162				99
163				>99

Note: Regression-predicted percentile ranks based on an 85-year-old with an MMSE score of 15.

Table A12. Norms for 80- to 89-Year-Olds With MMSE Scores Between 20 and 30

Raw	DLS	Communication	Global	Total
0	1			
1	1			
2	1			
3	1			
4	1			
5	1			
6	1			
7	1			
8	1			
9	1	<1		
10	1	1		
11	1	1		
12	1	1		
13	1	1		
14	1	1		
15	1	1		
16	1	1		
17	1	2		
18	1	2		
19	2	7		
20	2	13		
21	3	18		
22	3	22		
23	4	25		
24	4	31		
25	4	36		
26	5	44		
27	6	51		
28	6	58		
29	6	62		
30	7	68		
31	9	>99		
32	10			
33	12			
34	14		<1	
35	15		1	
36	19		1	
37	21		1	
38	26		1	
39	27		1	
40	31		1	
41	35		1	
42	37		1	
43	41		1	
44	47		1	
45	52		1	
46	54		1	
47	56		1	
48	59		1	
49	61		2	

Raw	DLS	Communication	Global	Total
50	63		2	
51	65		2	
52	67		2	<1
53	70		2	1
54	72		2	1
55	73		3	1
56	75		3	1
57	76		3	1
58	78		3	1
59	78		4	1
60	79		4	1
61	80		4	1
62	81		4	1
63	82		4	1
64	>99		5	1
65			5	1
66			5	1
67			6	1
68			7	1
69			7	1
70			8	2
71			9	2
72			11	2
73			12	2
74			13	2
75			15	2
76			15	2
77			17	3
78			21	3
79			22	3
80			25	3
81			26	4
82			27	4
83			29	4
84			30	4
85			30	5
86			32	5
87			34	6
88			36	7
89			38	7
90			41	7
91			43	7
92			46	7
93			46	8
94			48	9
95			49	10
96			50	10
97			52	12
98			53	14
99			57	14
100			59	15
101			60	16
102			62	17

(continued)

BAS NORMS

Table A12. (Continued)

Raw	DLS	Communication	Global	Total
103			64	19
104			66	20
105			67	21
106			70	24
107			76	26
108			76	27
109			76	29
110			76	30
111			76	33
112			76	35
113			76	38
114			76	39
115			78	43
116			78	43
117			79	44
118			80	47
119			81	49
120			83	52
121			84	54
122			86	56
123			87	57
124			87	59
125			88	61
126			88	62
127			89	64
128			89	65
129			89	67
130			90	69
131			>99	70
132				70
133				70
134				73
135				74
136				74
137				75
138				76
139				77
140				78
141				80
142				80
143				80
144				81
145				83
146				83
147				84
148				84
149				85
150				86
151				86
152				86
153				87

Raw	DLS	Communication	Global	Total
154				88
155				89
156				90
157				90
158				91
159				91
160				92
161				93
162				93
163				>99

Note: Regression-predicted percentile ranks based on an 85-year-old with an MMSE score of 24.

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