Everyday Memory in an Elderly New Zealand Population: Performance on the Rivermead Behavioural Memory Test

Sean Fraser and John N. Glass
Taranaki Base Hospital

Janet M. Leathem
Massey University

Assessment of memory is critical for evaluation for possible dementia. The Rivermead Behavioural Memory Test (RBMT) is one of the few measures known to have ecological validity when used with older adults. However, the norms for ages 70-94 may underestimate normal performance in well elderly people due to the sampling procedures adopted. This study reports RBMT normative data for 131 elderly, nondementing, community dwelling volunteers in New Zealand, in three age specific bands: 60-69, 70-79, 80-89 years.

Results showed significant differences between the data collected in Oxford and New Zealand. New Zealand results were higher on the summary Profile score and on six subtests with all but one of the probabilities at the $p<0.001$ level. In addition, the New Zealand data favoured the use of separate norms for the 60 to 69 age group. Factors contributing to the differences are discussed. It is concluded that the New Zealand data is representative of well, independent-living older adults in contrast to the Oxford data which represents a cross-section of elderly of varying health and dependency status. This study supports the collection of normative data for specific clinical groups.

The increase in average human life expectancy from less than 50 years at the turn of the century to almost 80 years at its end, has increased the impact of age related dementias on individuals, families, caregivers and professionals. Dementia is a mind robbing, body sparing condition, responsible for large health care expense in developed countries. It results in considerable disability and emotional trauma and leads eventually to death. The increase in cases of dementia has resulted in the condition being referred to as the epidemic of the century (Plum, 1979).

The only published prevalence study of dementia in New Zealand estimated that between 1992 and 2016, prevalence will increase by 96% to 100% (National Advisory Committee on Health and Disability [NACHD] 1997) compared to the estimated rise in the population of 18% to 26%. Early diagnosis is essential for treatment planning and relies heavily upon clinical examination, neuro-imaging data and neuropsychological testing (Kaszniak, 1986; Rosenstein, 1998). Testing is essential for determining the extent of memory loss, which is a primary requirement for diagnosis (Diagnostic and Statistical Manual of Mental Disorders [4th ed.], American Psychiatric Association, 1994). Test results are also useful for providing a catalogue of cognitive strengths and weaknesses from which disease progression can be objectively measured.

Despite the obvious need for reliable memory assessment, there are surprisingly few tests suitable for assessing an elderly population (Lezak, 1995). This lack has contributed to neuropsychological assessment with elderly being recognised as one of the greatest challenges facing the neuropsychologist (Loewenstein, Argüelles, Argüelles & Linn-Feuntes, 1994). But there are also a range of special considerations important when using tests with older populations which complicate the process (see Woodruff-Pak, 1997 for a discussion of these). Furthermore, it is likely that results from conventional tests of memory overestimate the level of deficit when used with elderly populations (Kausler, 1992). Measures with high functional (face) validity would appear to improve reliability and to overcome many of the practical difficulties encountered when faced with an elderly client referred for assessment of memory function (Cunningham, 1986). The Rivermead Behavioural Memory Test (RBMT) (Cockburn & Smith, 1989; Wilson, Baddeley, Cockburn & Hiorns, 1989) is an example of a limited number of functional measures and has proven useful in clinical work with older adults in a

New Zealand setting (Glass 1996). The RBMT focuses on practical memory tasks, such as recalling a short news item, remembering to do something at a certain time and putting a name to a face. An extra feature of the RBMT is that it has four parallel forms thus enabling repeat administration of the test without a practice effect.

But there are weaknesses associated with the RBMT. The normative sample of older adults gathered in Oxford, England attempted to be representative of all elderly with the result that it is probably not representative of well, independent older adults. The Oxford participants were recruited from the general population (n = 85), and from a local geriatric day hospital and occupants of floating beds in a community hospital (n=34). Although 106 (89%) were living in their own homes or in sheltered housing, the full sample were reported as receiving regular help to live independently from an average of 2.6 sources. It is also noted (Cockburn & Smith, 1989) that four participants were unable to complete all of the RBMT due to vision or speech limitations and a further 11 were unable or unwilling to complete the corollary tests used in the validation study. It is likely, therefore, that the Oxford norms over-represent the performance of unwell and semi-dependent elderly. This seems even more probable when, in a 1991 study of the same data, Cockburn and Smith discarded a total of 25 data sets from the original 119 because of difficulties participants had experienced in completing one or more of the measures used in the development protocol. Still later they discarded a further 15% (approximately 14) of the data sets from the final part of their analysis since it was thought the RBMT scores might represent an incipient dementia (Cockburn & Smith, 1991).

Formal norms have been published which provide summary Profile and Screening scores based on 106 subjects in the 70 to 94 year age group living in their own homes or sheltered housing (Cockburn & Smith, 1989). The manual also presents a summary of the standard scores for each subtest for numbers varying from 94 to 114 participants but no raw score data is provided. The norms for elderly excluded the 60 to 69 age group since earlier work had indicated that normal, cognitively intact people between the ages of 16 and 69 obtained similar or near similar scores (Wilson, Baddeley, Cockburn & Hiorns, 1989).

The current study reports data for well, independent-living older adults in three age bands between the ages of 60 and 89 years and compares this with the Oxford data for the two age bands 70-79 and 80-89. The assertion that people in the 60-69 age group obtain similar scores to those aged 16-69 is also investigated.

The main aim of the study was to produce a set of New Zealand performance standards for well, independent older adults while also clarifying whether there is a bias towards unwell and semi-dependent elderly in the Oxford normative data. In addition, the study sought to produce raw score subtest performance data for each of the three age bands. Glass (1996) observed a certain regularity in subtest failures when inspecting raw score clinical data obtained from clients diagnosed with a dementing condition. He suggested that increased attention to differential subtest scoring patterns could extend the use of the test to both a screening and a diagnostic tool. However, the lack of raw score normative data hampered further investigations since it could not be certain whether similar regularities occurred within the normal elderly population. One further purpose will be served through the current study. Literature searches indicate that the RBMT has been successfully translated for use in a number of countries, including Holland, China, Italy, Spain and Germany, but not specifically for use in the New Zealand culture. Comparative data would also be useful to validate minor changes made to terminology in the Story recall subtests to ensure their relevancy in the New Zealand context.

Method

Participants

Participants comprised 131 volunteers recruited from the wider New Plymouth region which has a population of approximately 45000. Several methods were used to recruit participants. These included speaking to various community groups, publicity on community radio and in local newspapers including a community newspaper which is delivered without charge to every household in the region, and notices placed at clubs where older adults were likely to meet. Word-of-mouth advertising was also effective and resulted in the inclusion of a number of people who would not usually volunteer, thus increasing the heterogeneity of the sample.

All participants were required to be between the ages of 60 and 89 years, to be living independently in the community, to be generally well and mobile and to report having no concerns about their everyday memory. A score of 9 or above was required on the short form of the Mini Mental Status Examination (Braekhus, Laake, & Engelkdal, 1992). In addition, participants were required to have no current cardiac or respiratory problems, no known history of cerebro-vascular disease and to report no history of major cardiac or respiratory illness in the preceding three year period.

All older adults who volunteered were contacted and invited to take part in the study if they considered they met the inclusion criteria. Initial contact identified some who had concerns about their everyday memory and wished to have this tested. These people were invited to make an appointment with the second author for follow-up and were not included in the study. In total, 138 predominantly Caucasian volunteers were entered in the formal test protocol and completed the two measures (see below). All volunteers were English speaking.

Data from 131 participants was used in the analysis. Seven data sets were removed as each scored more than 2.5 standard deviations below the mean summary Profile score of the relevant age group. In addition, one of these had obtained a score of 8 on the MMSE. Each of the seven later acknowledged concerns about their day-to-day memory which had led them to volunteer (or be encouraged to by a spouse). Five of the seven took up the option of referral for more comprehensive assessment with the second author.

Four were later diagnosed as having a dementing condition following medical and neuropsychological investigations, while the fifth was found to have a depressive disorder and a possible incipient dementia.

Table 1 summarises relevant demographic characteristics of the 131 participants. The average age of the sample was 72.71 years (71.91 and 73.85 females and males respectively.). Average years education (that is, primary and secondary school combined) was 10.46 years. The range in years of education was 6 to 16 for males and 7 to 18 years for females. There were no significant differences between age groupings and education or between gender and education. The mean MMSE score was 11.78 (range 10-12). The seven participants whose data was removed from the analysis comprised four females and three males with a mean age of 73.42 years (range 65-89), and mean education of 10.57 years (range 10-12). This group's mean MMSE score was 10.57 (range 8-12).

Table 1. Characteristics of Participants grouped by gender

Characteristic	Male	Female	Male + Female
Age (Mean years)	73.85	71.91	72.71
Age groupings (%)			
60-69 years	9.90	21.40	31.30
70-79 years	20.60	28.20	48.90
80-89 years	10.70	9.20	19.80
Education (Mean years)	10.40	10.63	10.46
Education by age group			
60-69 years	10.82	10.34	10.50
70-79 years	10.19	10.58	10.42
80-89 years	10.37	10.46	10.47

Measures

12 Item Version of the Mini Mental Status Examination (MMSE-12):

The MMSE (Folstein, Folstein & McHugh, 1975) is one of the most widely used brief screening instruments for dementia (Morris, Heyman, & Mohs, 1989). It is a 20-item measure, taking about 10 minutes to administer and with no significant gender biases (Tombaugh & McIntyre, 1992). However, Braekhus, Laake & Engelkdal (1992) hypothesised that not all the items in the original 20-item MMSE were equally efficient in identifying cognitive impairment and isolated the 12 items with greatest sensitivity to dementia. Their 12-item version correlated at.96 with the full MMSE and a cut-point of 9 was established as giving a sensitivity of .98 and a specificity of .91 in 831 adults with a mean age of 81.5 years. An advantage of the 12 item version is that it takes only 5 minutes to administer making the test process less strenuous for the older adult.

The Rivermead Behavioural Memory Test (RBMT)

This test is comprised of 12 subtests, (recall of name, recall and whereabouts of a belonging, remembering to make an appointment, immediate and delayed recall of a story and a route traced around the room, recall of faces and objects, orientation and knowledge of the date).

Raw scores are converted to Profile scores of 0 (abnormal), 1 (borderline) or 2 (normal) adding to a total possible Profile score of 24. Screening scores are determined on a pass (1) or fail (0) basis. The measure has high inter-rater and alternate-form reliability and validity was confirmed by a <.001 correlation between RBMT results and therapists' ratings on a behavioural-memory checklist (Wilson et al., 1989). Full details of the test can be found in the test manual and elsewhere (Cockburn & Collin, 1988; Cockburn & Smith, 1989; Cockburn & Smith, 1991).

Procedure

Special care was taken to keep anxiety levels of participants to a minimum. Participants were engaged in general non-test related conversation for a few minutes before being presented with a page of information outlining the reasons for the study and the process involved. Before being asked to complete a consent form, each participant was given the chance to ask any questions relating to the procedure. Participants were given the choice of taking the tests in their own homes or at an outpatient facility away from the main hospital complex. Thirty-two chose their own homes and the remainder the outpatient facility. The former group obtained a slightly lower mean summary Profile score (19.47) compared to those who attended the outpatient facility (20.03) but there were no differences in subtest raw scores. Version B of the RBMT was administered to 80% (n=105) of the participants and Version A to the remaining 20% (n = 26). This was to check for possible gender bias identified in the Story recall subtest and a possible lack of clarity in gender identification in the Face recognition subtest in Version A (Glass, 1996), although the Oxford researchers had reported a correlation of .86 between the two versions. The summary Profile scores and subtest raw scores were compared between the 26 who completed Version A and an age, education and gender matched group who had completed Version B. Independent samples t-tests indicated no significant differences on any of the comparisons. The summary Profile scores for the two versions correlated at 0.94.

The RBMT was administered irrespective of the MMSE score. All subtests were administered according to the manual. Once the measures were completed, each participant was invited to comment on the test and procedure and asked not to discuss the test with anyone else. Couples who volunteered were tested consecutively. No other formal measures were administered to determine whether participants might be experiencing daily memory problems. If participants had concerns about their performance, they were invited to discuss these with the second author.

Results

Comparison with Oxford norms

Table 2 presents a comparison between the Oxford standard

Table 2. Comparison of Oxford and New Zealand norms

	New Zealand (n = 90)		Oxford (n = 114)		
Subtests	M	SD	M	SD	t
Names	1.14	.94	0.87	.93	1.44
Belonging	1.48	.77	1.20	.78	1.89
Appoint	1.47	.75	1.16	.77	2.11
Pictures	1.90	.37	1.71	.60	2.41
Story Ia	1.61	.61	1.13	.89	3.85***
Story Db	1.83	.43	1.19	.89	5.98***
Faces	1.72	.56	1.53	.69	2.07*
Route Ia	1.61	.65	1.41	.79	0.10
Route Db	1.59	.72	1.62	.69	0.89
Message	1.42	.82	0.86	.83	4.20***
Orientn	1.86	.40	1.46	.76	4.55***
Date	1.90	.40	1.35	.85	5.43***
Total Profile	19.50	3.00	15.54	5.54	4.81***

a Immediate recall; b Delayed recall.
*p <.05; **p <.01; ***p <.001

Profile scores and the current data. Data for both the summary Profile scores and for each of the 12 subtests are summarised. Because the data available for the Oxford sample is for a 70-90 year old population only, the 60-69 year age group was removed for this analysis to enable a direct comparison to be made. An Independent-samples t-test was used to compare the two sets of means. As shown in Table 2, the mean scores on 6 of the 12 subtests and on the summary Profile score were significantly higher for the New Zealand sample.

Age group comparisons for New Zealand data

Table 3 presents summary data by age grouping for each of the subtest raw scores and for the summary Profile scores. A decrease in mean scores was associated with increasing age on many of the subtests though the variation in the summary Profile score was approximately only one point between the youngest and the oldest age grouping. A nonsignificant F ratio was obtained for the differences between the summary Profile scores. When the subtest scores were analysed separately, a significant F ratio was obtained for the differences between the three age groupings on the Appointment subtest ($F[2,128] = 3.235$, $p<.05$) but for no other subtests. Further investigation using Tamhane's post hoc multiple comparison method (Coakes & Steed, 1996), revealed no significant differences on any of the comparisons between subtests and age groups. While the Appointment subtest approached significance ($p = .07$) this was only for the comparison between the 60 – 69 and the 80 – 89 year age groups. Multiple comparison methods tend to be conservative in assessing significance (Everitt, 1996). As a further check, a t-test analysis was run which did report a significant difference for the above age comparison on the Appointment subtest, but for no others.

Discussion

As expected, significant differences emerged between the Oxford and New Zealand data across the age groups 70-89 which applied to the summary Profile scores and to six of the standardised subtest scores. In addition, the 60-69 age group obtained a mean Profile score substantially below that predicted by the Oxford normative data for normal controls aged between 16 and 69 years.

The 70-89 year old volunteers in the current study scored an average of 4 points higher on the Profile score compared to the Oxford 70-89 year olds. Based on this finding it is likely that the Oxford norms underestimate normal performance in this age range. Furthermore, comparison of Profile scores between the current sample's 60-69 age group and the Oxford broader 16-69 age group, indicates that the Oxford data may overestimate normal performance in the 7th decade. Wilson et al, (1989) concluded that elderly norms were necessary only for the oldest decades beyond 69 and published a Profile score for the 16–69 age group of 22-24 (standard deviation: 1.74). Based on this estimation, the Profile score for the well-normal 60-69 year olds in the current sample is almost one standard deviation below the mean. According to Wilson et al, (1989) such a result is classified as "poor memory". However, it seems more likely that a normal Profile score for a person in this age range is closer to 20.57 as obtained in the current study. This conclusion is supported by data from the van Balen et al, (1996) study in which similar Profile scores of 20.50 for the 60-69 group were obtained. These findings would support the provision of separate norms for older adults from approximately the seventh decade.

There were a number of factors which could account for, or contribute to, these differences. As noted, the Oxford sample appeared to have at least a moderate level of dependency and may have been overrepresentative of unwell, semi-dependent older adults. Further support for this assertion is found in both the initial standardisation study and in later studies of the same sample where it becomes apparent that approximately 39 (33%) of the data sets were discarded from various analyses because of doubts about reliability. As 5-8% of individuals over the age of 65 can be expected to develop dementia, (Rosenstein, 1998) it could be assumed that a number of the participants in the Oxford sample were in the early stages of a dementia at the time of testing. No mention is made in the Oxford study of screening for dementia prior to testing but as noted, a later study from the Oxford group identified 14 cases suspected of having an incipient dementia. Although discarded from some of the later data analyses, this subgroup were nevertheless included in their normative data.

By comparison, the New Zealand participants were all community dwelling. All participants were administered a cognitive screen as part of the research protocol although only one obtained a score below the cut-point of 9. However, as noted earlier, seven of the volunteers were excluded due to obtaining abnormally low RBMT summary Profile scores and each later acknowledged some degree of concern about their everyday memory. This number comprised

approximately 5% of the total volunteer sample which equates with prevalence estimates of dementia in adults over 65 years of age (Rosenstein, 1998).

Test fatigue is a further factor that may have contributed to the differences between the Oxford and New Zealand data. The Oxford participants were asked to complete a battery of 5 comprehensive tests taking a total of 1.5 hours to complete (Cockburn & Smith, 1989). It could be assumed that fatigue over this period had some effect on results. In contrast, the New Zealand participants were involved for only 35 minutes.

The effects of anxiety on test performance with older adults have been well documented (e.g., Beech & Harding, 1990; Woodruff-Pak, 1997) and may have been a further influence on RBMT performance between the two samples. Efforts were made in the current study to reduce possible anxiety by using a quiet office, with a large window overlooking a garden. Participants were engaged in general conversation and were offered tea, coffee or water prior to testing. Whether such steps to minimise anxiety levels were taken in the Oxford study is not stated. On the other hand, not all studies report anxiety to have a negative effect, (Koenders, Passchier, Teuns, & van-Harskamp, 1993) and there is evidence that severity of memory impairment on the RBMT is not significantly associated with results obtained from formal measures of anxiety and depression (Grubb,O'Carroll, Cobbe, Sirel, & Fox, 1996). Whether or not anxiety had an effect on test scores is therefore debatable, especially as observations indicate less evidence of anxiety amongst older adults taking the RBMT than with many conventional tests which use unfamiliar material.

It could be argued that the New Zealand group were not representative of the general population either. All were volunteers and represented a well, generally active older adult population, especially the 80-89 year age group. They could therefore be seen to represent a stratified cross-section of older adults. Furthermore, the average level of formal education in the current sample at 10.46 years was approximately one year higher than that of the Oxford sample's 9.51 years. While this may have had some impact, there is evidence that education level has little effect on subtest performance in well-normal older adults other than on the Story recall subtests (Cockburn & Smith, 1991; Glass, 1999). It could also be argued that the seven outlying scores represented the false positives rate associated with the RBMT and that their removal reduced the generalisability of the current findings. As four of the five who opted for further investigations were diagnosed over the ensuing 12 month period as having a dementing condition, it seems that the decision to remove such low scorers was valid even in the absence of a low MMSE score. Furthermore, it has been noted that most cognitively intact people up to the age of at least 69 should obtain normal or near normal scores on the RBMT (Wilson et al., 1989), and there is evidence that this age range can be extended to age 89 years (Glass, 1999; Ostrosky-Solis, Jaime, & Ardila, 1998). The use of the MMSE-12 could be seen as a possible limitation in the current study since it identified only one of the seven participants found to have memory difficulties. For future studies, the addition of the Behavioural Memory Checklist (Wilson et al. 1989) is being considered.

If the purpose of using a measure of memory is to determine the extent to which the scores of any one individual deviates from those of a group with intact memory, the New Zealand data would appear to be clinically

Table 3. Means & standard deviations of RBMT sub-test raw and profile scores for the New Zealand sample

	Age Groupings											
	60-69 n=41 Scores				**70-79** n=64 Scores				**80-89** n=26 Scores			
Subtest	Raw		Profile		Raw		Profile		Raw		Profile	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Names	3.37	(0.99)	1.44	(.81)	2.89	(1.38)	1.11	(.96)	2.96	(1.28)	1.23	(.91)
Belong	3.49	(0.71)	1.51	(.71)	3.39	(1.14)	1.53	(.78)	3.08	(1.35)	1.34	(.75)
Appointment	1.68	(0.61)	1.71	(.60)	1.55	(0.71)	1.55	(.71)	1.23	(0.86)	1.27	(.83)
Pictures	9.93	(0.26)	1.90	(.30)	9.91	(0.39)	1.89	(.40)	9.88	(0.33)	1.92	(.27)
Story.I	6.63	(2.55)	1.59	(.67)	6.76	(2.36)	1.55	(.67)	6.58	(1.90)	1.77	(.43)
Story.D	5.70	(2.43)	1.83	(.44)	5.67	(2.06)	1.80	(.48)	5.21	(1.95)	1.92	(.27)
Faces	4.78	(0.48)	1.80	(.46)	4.66	(0.76)	1.73	(.54)	4.73	(0.72)	1.69	(.62)
Route.I	4.76	(0.49)	1.76	(.49)	4.58	(0.66)	1.56	(.69)	4.77	(0.43)	1.73	(.53)
Route.D	4.73	(0.55)	1.73	(.55)	4.56	(0.73)	1.56	(.73)	4.65	(0.63)	1.65	(.69)
Message	5.63	(0.66)	1.51	(.78)	5.39	(0.97)	1.45	(.83)	5.12	(1.31)	1.35	(.80)
Orientation	8.88	(0.40)	1.88	(.40)	8.83	(0.42)	1.83	(.42)	8.92	(0.27)	1.92	(.27)
Date	1.90	(0.37)	1.90	(.37)	1.84	(0.51)	1.88	(.45)	1.92	(0.39)	1.96	(.20)
Profile			20.61	(2.62)			19.55	(3.18)			19.62	(2.47)

helpful. It summarises the performance of a sample of well, reasonably active older adults and provides raw score standards for a range of everyday memory behaviours. Both the Oxford and current data could be used as benchmarks as part of more comprehensive stratified norms for different elderly clinical groups. For example, a large-scale Dutch study incorporated norms for well, independent elderly alongside those for clinical groups (van Balen, Westzaan & Mulder, 1996) but did not extend these to cover subtest raw scores.

The current study supports the conclusion that the Oxford normative data underestimates the performance of well, independent-living older adults aged 70-89 on the RBMT and slightly overestimates the performance of people in the age range 60-69. The study supports the need for separate norms for this age group. The study has produced a set of data reflecting the performance of generally well, mobile older adults. Comparisons can be made with the summary Profile scores and also with raw scores obtained on individual subtests.

In addition to being of use clinically, the current study lays the groundwork for future research examining the performance of patients from different diagnostic groups on this measure.

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Address for correspondence:
Janet M. Leathem, PhD
School of Psychology, Massey University
Private Bag 11-222, Palmerston North, NZ
Email: