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# Validating an Irish-language version of the Rivermead Behavioural Memory Test – Second Edition

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## Key words:

Assessment, memory, Irish language, occupational therapy.

**Introduction:** This study translates and assesses the psychometric properties of an Irish-language version of the Rivermead Behavioural Memory Test – Second Edition (Wilson et al 2003), a screening measure for memory impairment in adults.

**Method:** All four versions of the Rivermead Behavioural Memory Test – Second Edition were translated to Irish and administered to a sample of 21 participants aged 21–64 years. Equivalent translation of the Rivermead Behavioural Memory Test – Second Edition was achieved through multiple translations and back-translations of the instrument and field-testing with both bilingual and monolingual participants.

**Findings:** Strong evidence of concurrent validity was clear from the results. Test–retest reliability of the measure proved to be low in comparison with the English version. In general, the four parallel versions seem to be of equal difficulty, and the Irish version of the Rivermead Behavioural Memory Test – Second Edition was no more difficult than the English version.

**Conclusion:** The results support an Irish Rivermead Behavioural Memory Test – Second Edition as a valid test of everyday memory. Overall, the reliability of the tool is acceptable, but results must be considered cautiously due to the preliminary nature of the study and given the small sample size.

## Introduction

The Rivermead Behavioural Memory Test – Second Edition (RBMT-II, Wilson et al 2003) is an assessment that uses everyday tasks to determine gross memory functioning. Many studies (for example, van Balen et al 1996) have found the original Rivermead Behavioural Memory Test (RBMT, Wilson et al 1985) to be an ecologically valid memory test that it is well accepted by clinicians and patients. Its psychometric properties have been compared with other common memory assessments and found to be as good as and, in some cases, superior (Wilson et al 1989) to existing measures. Wilson et al (1989) found strong correlations between it and the Warrington Recognition Memory Test (Warrington 1984) and the digit span, spatial span, and paired associate learning subtests from the Randt, Brown, and Osborn Memory scale (Randt et al 1980). Everyday memory lapses also correlated strongly with the RBMT, as measured by clinicians' observations of memory lapses and subjective ratings from patients and relatives.

The RBMT (Wilson et al 1985) was developed because the authors found that existing memory assessments failed in addressing everyday life situations (Wilson et al 1985). This assessment was designed to address this issue while meeting the demands of standardization. The RBMT aimed to detect memory difficulties in patients with brain injury using analogues of everyday situations. It was also intended to be suitable for use in any number of environmental settings (Wilson et al 1988). The RBMT-II is an updated version of the original assessment; but while the materials such as photographs of people were updated, there was no re-standardization or change

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to subtest items. There are four parallel forms of the RBMT-II for repeat administration. A newer version of the assessment, the RBMT – Third Edition (RBMT-3, Wilson et al 2008), includes updated stories and a new novel task subtest. Many occupational therapy departments, however, are still using the RBMT-II.

Twelve subtests make up the RBMT-II and include items of prospective memory, recognition, orientation, and explicit memory. For each subtest on the RBMT-II two different scores are produced: a screening score and a standardized profile score. The screening score gives a pass or fail to each subtest. The standardized profile score gives subjects a pass, borderline, or fail. Normal memory is said to be between 10–12 screening score or 22–24 profile score. The instrument was designed in order to be passed by the majority of normal controls (Wilson et al 1989).

The psychometric properties of the RBMT have been studied extensively. One hundred percent agreement between raters was reported in the original standardization study, as well as high parallel form reliability (Wilson et al 1989). Correlation between administrations was reported to be between 0.78 and 0.85 (Wilson et al 2003). Content, construct, concurrent, and ecological validity of the English RBMT are well established (Wilson et al 1985).

The challenge of cognitive testing within groups is emphasised by a study of 3,734 Japanese American men aged 71–93 years by Yano et al (2000), where it was found that subtle deficiencies in language proficiency, not usually evident in daily life, can lead to lower performance on cognitive assessment. When bilingual participants were tested in English, lower cognitive performance was noted in these non-brain damaged participants than when participants were tested in their native Japanese, when significantly higher scores on cognitive performance were apparent. Both cultural characteristics of communication and external influences can have an impact on the way in which language is spoken and can give rise to different dialects and listening characteristics (Molrine and Pierce 2002, Paradis 2001), which may in turn have an impact on a person's performance on formal assessments.

The RBMT-II has been translated into 13 different languages but had not, to date, been translated into Irish. Having linguistically and culturally appropriate measurement tools for clinical practice is very important, particularly in diagnosis. The RBMT-II is commonly used within an Irish-speaking population whose performance may be improved by assessment through the Irish language.

## Method

### Research design

There is no standard guideline for the translation of instruments, and the quality and methods used vary widely (Maneesriwongul and Dixon 2004). The most reliable method of developing an equivalent translated instrument, as suggested by a large number of authors (for example, Duffy 2006, Jones et al 2001, Hilton and Skrutkowski 2002,

Hwang 2005, Maneesriwongul and Dixon 2004), is Brislin's (1970) model of translation; this was used as a guide to translate the four versions of the RBMT-II to Irish. Brislin's model involves both translation and back-translation of the instrument. All translators used in the study had formal credentials as translators in the target language. In order to avoid any potential information bias, none of the translators had any medical background.

The following steps were taken in translating the RBMT-II to Irish:

- *Step 1:* The RBMT-II was translated from source language (English) to target language (Irish) by a bilingual translator.
- *Step 2:* Forward-translation alone is considered to be the least thorough translation process (Maneesriwongul and Dixon 2004) because the adequacy of the translation cannot be verified, so the Irish language RBMT-II was back-translated by an independent translator, who had no contact with the translator of the forward translation and no knowledge of the original instrument.
- *Step 3:* The original RBMT-II was then compared with the back-translated RBMT-II. Linguistic sameness of both versions in source language was examined, as well as cultural relevance. The authors compared the original and back-translated versions to see if the instructions were the same, that there was the same number of 'ideas' in the story recall paragraphs, and that people and place names were as common in Ireland as the ones used in the English language version — for example, if the name John was used and is the fifth most common name in England, then the fifth most common name in Ireland would be used in its place. On examination, the semantics of the instrument appeared to be equivalent to that of the original instrument. Syntactical differences were visible, most likely due to structural differences in the languages. Sentences are constructed differently in the Irish language than in English so were not rearranged in translating the instrument directly, in order to remain more natural when read to participants.
- *Step 4:* The instrument was pre-tested with a small sample of the target population in order to check the quality and practical aspects of test administration. Two bilingual participants were assessed: one male and one female aged 58 and 59 years respectively. In order to test for any discrepancies, both English RBMT-II and Irish RBMT-II were administered once to each participant, with random selection of each version of the RBMT-II (A, B, C, D) and whether the participant completed the Irish language RBMT-II or the English language RBMT-II first. Observations and feedback from participants revealed that there were phrasing difficulties in certain subtests and unnatural language that caused confusion. Results indicated that further translation was justified in order to achieve maximum equivalence.
- *Step 5:* The RBMT-II was re-translated by a new independent bilingual translator from source to target language.
- *Step 6:* The Irish RBMT-II was back-translated by a new independent translator to the source language.

- **Step 7:** The back-translated and original versions of the RBMT-II were compared by the researcher in order to identify any error in meaning. In examining the back-translation for problems identified in pilot testing, previous syntactical difficulties were eliminated in the retranslated version. The researcher was fluent in both languages and so it was evident through examination of the text that syntactical errors were no longer present.
- **Step 8:** The new back-translated version of the test was administered to two English-speaking (monolingual) participants, along with the original RBMT-II, in order to compare responses and examine if different subtests yielded different scores. This was carried out, following the difficulty with the first translation, in order to clearly identify problem areas in the instrument. Both versions of the test were in English. One male and one female participant, aged 52 and 53 years respectively, completed one randomly selected version of each of the two RBMT-II; original and back-translated version. Administration was counterbalanced, so that one participant completed the back-translated version first and one participant completed the original RBMT-II first, with the hope of reducing response bias. Results found that there were little differences between the two versions, with both participants scoring within the same memory category on both instruments. Results from field-testing and identifying no error of meaning suggested that maximal equivalence of the instrument was established. Maneesriwongul and Dixon (2004) suggested that the most complete translation process is back-translation combined with both bilingual and monolingual tests.

## Participant selection

A convenience, non-probability sample was used due to the necessity of time constraints. Ethical clearance was given by the National University of Ireland, Galway Ethics Committee.

Staff and students of Irish-speaking departments and societies in the National University of Ireland, Galway were contacted either through an email, a 5-minute talk at the beginning of a lecture, or posted letters of recruitment that described the objectives of the research and what would be required if they took part. Participants with the desired characteristics were difficult to locate because there were few native Irish speakers available. For this reason, snowball sampling was also used, with recruited participants identifying other potential participants.

The following inclusion criteria for participants were applied:

- Age between 16 and 69 years.
- Either native Irish speakers or speaking Irish confidently and regularly (at least 2–3 times a week).
- No self-reported history of significant mental health problems, head injury, or neurological impairment.

Having given informed consent, all participants were told that they were free to leave the study at any time without giving

a reason. All participants were given the option of receiving the results assessments. Twenty-five people were recruited for the study, and of these two male and two female participants were used only for the pilot testing of the Irish RBMT-II, as described above. Although the sample was small, it was hoped to have a representative group of the target population by maintaining a balance of gender, age, and occupation. Participants' ages ranged from 21 to 64 years (mean 38.5, SD 13.7). There were 11 female and 10 male participants. No significant difference was shown between male and female participants in performance on total scores or any of the individual subtests.

## Procedure

Administration of the RBMT-II was counterbalanced both by language and by the version of the test administered. Each participant completed two versions of the Irish RBMT-II and one of the four versions of the English RBMT-II. All participants completed version A of the Irish RBMT-II. Version B, C, and D were administered an equal number of times each, either in English or Irish. Each version of the Irish RBMT-II was administered to seven participants. Order of presentation was randomized and at least 1 week was left between each administration in order to reduce the possibility of a practice effect.

Administration took place in the occupational therapy department in the university or in participants' own homes or offices, as per participants' preferences. For each participant the setting was the same for all three administrations. Directions and instructions of the RBMT-II were followed, and were identical for each administration. Each assessment was scored immediately following each session. Data were entered into the Statistical Package for Social Sciences (SPSS) Version 14 (SPSS Inc. 2005) at the end of each administration.

## Findings

### Validity

Content, construct, and ecological validity of the English RBMT-II are well established (Wilson et al 2003) and so were inferred to be present in the Irish-language version. Concurrent validity of the Irish RBMT-II was established through comparing participants' scoring on the Irish-language version with that of the English RBMT-II.

Mann-Whitney U-tests examined the differences between total scores and subtest scores on standardized profile and screening scores. There were no significant differences between total scores on the Irish and English RBMT-II, either in standardized profile scores or screening scores (Irish RBMT-II: mean = 10.33, SD = 1.33; English RBMT-II: mean = 10.45, SD = 1.28). No significant difference overall was found between participant scores in different languages. Details of means, standard deviations, and significance levels of each subtest using standardized profile scores are shown in Table 1.

**Table 1. Differences between Irish and English RBMT-II standardized profile scores**

Item	Irish RBMT-II (n = 40)		English RBMT-II (n = 20)		p
	M	SD	M	SD	
Names	1.63	0.67	1.56	0.69	N.S.
Belonging	2.00	0.00	2.00	0.00	N.S.
Appointment	1.70	0.46	1.75	0.44	N.S.
Pictures	1.85	0.43	1.90	0.45	N.S.
Story – immediate	1.38	0.74	1.56	0.69	N.S.
Story – delayed	1.83	0.39	1.80	0.52	N.S.
Faces	1.88	0.35	1.85	0.37	N.S.
Route – immediate	1.95	0.22	1.95	0.22	N.S.
Route – delayed	1.95	0.22	2.00	0.00	N.S.
Message	1.93	0.27	1.90	0.31	N.S.
Orientation	1.93	0.27	1.95	0.22	N.S.
Date	1.88	0.34	1.80	0.52	N.S.
Total	21.88	1.88	22.00	1.78	N.S.

Note: N.S. = non-significant.

Kruskall-Wallis tests further investigated whether there was any difference between English RBMT-II, Irish RBMT-II administration 1 and Irish RBMT-II administration 2. No significant difference overall was found between participant scores in different languages. This was further confirmed by using Mann-Whitney U-tests to assess differences between English RBMT-II and Irish RBMT-II administration 1 profile scores ( $z = -0.855$ ,  $p = 0.392$ ) and English RBMT-II and Irish RBMT-II administration 2 ( $z = -0.594$ ,  $p = 0.552$ ) where no significance was found.

On screening and profile scores no significant difference was found between Irish and English RBMT-II. Of the mean scores between the two languages, five subtests had marginally higher scores in English, five had marginally higher scores in Irish, and two subtests showed no difference. This suggests that both versions of the instrument are of equal difficulty.

## Reliability

### Test–retest reliability

All participants were tested on two different versions of the Irish RBMT-II with at least 1 week between administrations, which was randomized across individuals, in order to assess the instrument's test–retest reliability. Participants were tested on the Irish RBMT-II on administration 1 and 2, administration 2 and 3, or administration 1 and 3.

Kruskall-Wallis tests showed that scores were significantly different between the three administrations on total standardized profile scores ( $X^2 = 10.232$ ,  $df = 2$ ,  $p = 0.006$ ) and total screening scores ( $X^2 = 12.142$ ,  $df = 2$ ,  $p = 0.002$ ). A breakdown of the differences between each subtest using Kruskal-Wallis, and means and standard deviation, is available in Table 2.

The overall mean level of performance on administration 1 was 20.27 for the profile score and 9.09 for the screening score; for administration 2, scores were 22.44 for profile scores and 10.81 for screening scores; and for administration 3, scores were 22.54 mean total for standardized profile score and 10.77 for the screening score on Irish RBMT-II. Mann-Whitney U-tests were used in further studying the differences between total scores on administration; it was found that significant differences only appeared between administration 1 and 2 ( $z = -2.775$ ,  $p = 0.006$ ) and between administration 1 and 3 ( $z = -2.824$ ,  $p = 0.005$ ). No significant difference was apparent between administrations 2 and 3.

The tendency for improved performance on second testing was studied in more detail. It was found through examining the subtests that two items were resulting in improved performance: 'remembering an appointment' ( $X^2 = 14.942$ ,  $df = 2$ ,  $p = 0.001$ ) and 'story recall immediate' ( $X^2 = 7.661$ ,  $df = 2$ ,  $p = 0.022$ ). Thirty percent of participants improved their score on the 'remembering an appointment' subtest, while no participants scored lower on subsequent administrations. The 'remembering an appointment' subtest score was found to increase significantly between administrations

**Table 2. Differences between administrations of Irish RBMT-II**

Item	Admin 1 (n = 11)		Admin 2 (n = 16)		Admin 3 (n = 13)		p
	M	SD	M	SD	M	SD	
Names	1.27	0.91	1.69	0.60	1.85	0.38	N.S.
Belonging	2.00	0.00	2.00	0.00	2.00	0.00	N.S.
Appointment	1.27	0.47	1.75	0.45	2.00	0.00	Signif ***
Pictures	1.82	0.60	1.94	0.25	1.77	0.44	N.S.
Story – immediate	0.91	0.70	1.44	0.73	1.69	0.63	Signif **
Story – delayed	1.73	0.47	1.88	0.34	1.85	0.38	N.S.
Faces	1.82	0.41	1.94	0.25	1.85	0.38	N.S.
Route – immediate	2.00	0.00	1.94	0.25	1.92	0.28	N.S.
Route – delayed	2.00	0.00	1.94	0.25	1.92	0.28	N.S.
Message	1.82	0.41	1.94	0.25	2.00	0.00	N.S.
Orientation	1.82	0.41	2.00	0.00	1.92	0.28	N.S.
Date	1.82	0.41	2.00	0.00	1.77	0.44	N.S.
Total	20.27	1.85	22.44	1.79	22.54	1.20	Signif **

Note: N.S. = non-significant, \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.001$ .



**Table 3. Differences between versions of the Irish RBMT-II**

Item	A	(n = 20)	B	(n = 9)	C	(n = 4)	D	(n = 7)	p
	M	SD	M	SD	M	SD	M	SD	
Names	1.65	0.67	1.33	0.87	1.75	0.50	1.86	0.38	N.S.
Belonging	2.00	0.00	2.00	0.00	2.00	0.00	2.00	0.00	N.S.
Appointment	1.70	0.47	1.56	0.53	2.00	0.00	1.71	0.49	N.S.
Pictures	1.70	0.57	2.00	0.00	2.00	0.00	2.00	0.00	N.S.
Story – immediate	1.40	0.75	0.89	0.78	2.00	0.00	1.57	0.54	N.S.
Story – delay	1.85	0.37	1.56	0.53	2.00	0.00	2.00	0.00	N.S.
Faces	1.90	0.31	1.78	0.44	2.00	0.00	1.86	0.38	N.S.
Route – immediate	1.95	0.22	2.00	0.00	1.75	0.50	2.00	0.00	N.S.
Route – delay	1.95	0.22	2.00	0.00	1.75	0.50	2.00	0.00	N.S.
Message	1.90	0.31	1.89	0.33	2.00	0.00	2.00	0.00	N.S.
Orientation	2.00	0.00	1.78	0.44	2.00	0.00	1.86	0.38	N.S.
Date	1.90	0.31	2.00	0.00	1.75	0.50	1.71	0.49	N.S.
Total	21.90	1.86	20.78	1.99	23.00	1.41	22.57	1.62	N.S.

Note: N.S. = non-significant.

1 and 2 ( $z = -2.406$ ,  $p = 0.016$ ) and between 1 and 3 ( $z = -3.687$ ,  $p = 0.000$ ). For the ‘story recall immediate’ subtest, in which a difference of significance was found, 40% of participants improved their score, while 10% had a lower score on subsequent administrations. Mann-Whitney U-tests found that the significant improvement in scores was only apparent between administrations 1 and 3 ( $z = -2.663$ ,  $p = 0.008$ ) and not between administrations 1 and 2 or 2 and 3.

### Parallel-form reliability

Two versions of the Irish RBMT-II, in which the order of presentation was randomized (using generators available at [www.randomization.com](http://www.randomization.com)) were administered to participants in order to determine the instrument’s parallel-form reliability. All participants completed version A of the Irish RBMT-II, and approximately one-third completed version B, one-third completed version C, and one-third completed version D. Mean scores were: version A — 21.9 profile score, 10.4 screening score; version B — 20.78 profile score, 9.67 screening score; version C — 23 profile score, 11 screening score; and version D — 22.57 profile score, 10.57 screening score.

Differences between subtests on standardized profile scores, as well as means and standard deviations, are shown in Table 3. Total score differences between alternative versions of the Irish RBMT-II using Kruskal-Wallis tests found no significant differences ( $X^2 = 6.411$ ,  $df = 3$ ,  $p = 0.093$ ). On inspection of mean rank scores it was found that version B had the lowest overall ranking of the four versions ( $A = 20.6$ ;  $B = 13.39$ ;  $C = 28.13$ ;  $D = 25$ ).

## Discussion

Preliminary validity of the Irish-language RBMT-II is promising, although the reliability of the measure may need further investigation. A practice effect was found on two subtests: ‘remembering an appointment’ and ‘story recall immediate’. In the original standardization study of the RBMT a similar

effect was noted on the ‘remembering an appointment’ subtests, where a significant improvement was found on second administration. Twenty-eight percent of participants improved their scores on the ‘remembering an appointment’ subtest in the study (Wilson et al 1989); similarly, 30% of the current sample studied improved. This item is one of the three items of prospective memory assessed by the instrument. Reminding yourself to do something at a particular time in the future is a common difficulty in everyday life (Baddeley 1981). The other two items of prospective memory, ‘remembering a belonging’ and ‘delivering a message’, were at or close to ceiling on each administration. Because none of the participants had a diagnosed memory problem, there was an opportunity for learning on each subsequent administration, which was strengthened by the fact that the time constraints of the study did not allow for more than about 1 week between administrations. Participants were not given any immediate feedback on their performance during or between administrations. Unlike the study by Wilson et al (1989) where participants were only assessed twice, some participants in this study were not assessed for a second time on the Irish RBMT-II until their third overall administration and so would be primed.

Although small, a learning effect was noted in the ‘story recall immediate’ subtest. This was seen in participants who were tested on the Irish RBMT-II on their first and third administrations, and was not reported by previous authors. This result is reasonably unexpected as four different passages make up the four different versions. It could be speculated that, as participants became more familiar with the task, they were more aware of what was required and so performed better. Priming and practice effects are not uncommon in memory tests, and their effects are difficult to control for, even in this case where there were four different versions available. In a study of African American and Caucasian adults on various tests of aphasia it was found that in a paragraph retelling subtest, similar to the story recall subtests of the RBMT-II, African American participants scored significantly

lower because their narrative recounts did not contain sufficient quantitative as well as qualitative detail (Molrine and Pierce 2002). They were penalised because they were seeing the story as a whole rather than for its individual parts. This may have been the case for the first administration of the RBMT-II, leading to an increase in performance as participants retold more of the detail of the story on subsequent administrations.

In the original standardization study, parallel-form comparisons were made between version A and versions B, C, and D, but these versions (B, C, and D) were not analysed against each other (Wilson et al 1989). All versions were compared against each other in the present study; overall, the four different versions of the Irish RBMT-II appear to be equivalent in difficulty, although a small but significant difference in profile scores indicates that version B may be the most difficult of the four versions, in particular the story recall subtests. Because no difference was found between versions on screening scores it is advised to use screening scores with version B of the instrument, although it is unlikely that using the profile scores of version B would falsely diagnose, as the scores are still in the same memory category. Similarly Wilson et al (1989) found that participants were narrowly failing version D on screening scores and not on profile scores, and advised the use of profile scores with version D of the RBMT.

Instruments need to produce the same results at repeated intervals; there must also be stability across different raters (Corr and Siddons 2005). An obvious limitation of this study is that, because there was only one investigator, inter-rater reliability was not investigated. As there was only one unblinded investigator in the study there was potential for bias. Strict adherence to the guidelines of the standardized assessment reduced this possibility. Test-retest reliability may have been stronger if time limits had allowed more than 1 week between administrations. The effects of learning and priming may have been reduced had there been longer time intervals between administrations. Another limitation regarding psychometric properties is the assumption that was made that content, construct, and ecological validity were maintained in the Irish RBMT-II because they are well established in the English RBMT-II. It would have enhanced the validity of the instrument if these forms of validity were also investigated and not assumed to be consistent with the English RBMT-II.

The small sample of convenience that was used may have an effect on the generalizability of the findings of this study, although it was hoped to maintain a representative sample of the target population. It cannot be fully determined whether the population chosen are representative of native Irish speakers. Future studies should aim to include a larger sample chosen in a more random way in order to strengthen the generalizability of any future research. It would also be essential to include participants and raters of differing dialects in order to assess whether this had any influence on performance. In the Irish language there are many different dialects, each with quite distinctive phrases, accents, and sayings.

Differences within groups are not reported here because of the small number of participants but a further study with a sufficiently large representative sample exploring differences of age, education, and IQ would provide this.

## Conclusion

Having assessments available to clients in Irish facilitates the delivery of services in this language by clinicians in therapy and rehabilitation departments. This is a preliminary study and the sample is small, but nevertheless results suggest that the Irish version of the RBMT-II is a valid test of everyday memory. This is the first known attempt to make assessments available to an Irish-speaking population and aims to facilitate the delivery of services through Irish to brain injured patients who may have difficulty communicating in their second language. With an ageing population and the increase in survival rates after traumatic brain injury there will be an increased demand for services in Irish.

### Key findings

- Equivalent translation to the Irish language was achieved through the thorough process of multiple translations and back-translations of the instrument and field-testing.
- Test-retest was low compared to the English equivalent but concurrent validity proved strong.
- Further testing of the instrument's psychometric properties is recommended.

### What the study has added

This study demonstrates the process of translating an instrument to another language in order to facilitate client-centred assessment. Results found the Irish translation of the RBMT-II to be acceptable and support is provided for its use in practice.

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**Research ethics:** Ethical clearance was given by the National University of Ireland, Galway. Since this study formed part of a student project, ethical approval was cleared via the university department concerned.

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