MAR Neurology, Neurosurgery & Psychology (2024) 8:3
Research Article

Psychometric Characteristics of Logical Memory Subtest of Wechsler Memory Scale-Revised among a Clinical Sample of People with Schizophrenia and a Sample of Healthy People in Jordan

Rana Masood [1], Moh'd A. Shoqeirat. [2]

1, MA. Clinical Psychologist.
2. Dept. of Psychology, Faculty of Art and Science, AL-Ahliyya Amman University.

*Correspondence to: Moh'd A. Shoqeirat. Dept. of Psychology, Faculty of Art and Science, AL-Ahliyya Amman University.

Copyright

Received: 16 April 2024

Published: 01 May 2024

DOI: https://doi.org/10.5281/zenodo.11122027

Abstract

This study investigates the psychometric characteristics of the Logical Memory subtest of the Wechsler Memory Scale-Revised. The sample of the study consisted of (110) patients with schizophrenia (50 acute and 60 chronic) and (100) healthy people. Logical Memory subtest and Mini-Mental Examination Test were used.

The results showed that the Logical Memory subtest has acceptable validity characteristics (discriminative, construct, and referrers) and acceptable reliability characteristics (consistency, split half and test-retest). In addition, the results showed that healthy people have higher Logical Memory than the schizophrenic sample, and chronic schizophrenics have higher Logical Memory than acute schizophrenics. The results also showed no sex differences among the schizophrenic sample and showed a positive correlation between the Logical Memory subtest and the Mini-Mental Examination Test.

Keywords*: Logica memory, validity, reliability, schizophrenia, Wechsler memory scale.*

Introduction

Schizophrenia is a chronic psychotic disorder that affects about 1% of people in their lifetime. The incidence is equal between males and females, but the disorder is more severe in males than females. The onset of the disorder in males is at the age of (20-24), and in females is at the age of (25-29). Most people with schizophrenia have significant difficulties with many daily activities, such as work, taking care of themselves (personal hygiene), and maintaining relationships with others. (Vita, 2018).

Schizophrenia is a psychotic disorder whose symptoms are characterised by distortion in thinking, language, cognition, controlling emotions, and behaviour (Simpson, 2010).

Schizophrenia symptoms are classified as positive, negative, and cognitive. Positive symptoms add something unusual to an individual's experiences, behaviours, or thinking. These symptoms include hallucinations, delusions, disturbed thinking, and disorganised behaviour (American Psychiatric

Association, 2013).

Negative symptoms include social withdrawal, impaired environmental interaction, and a lack of motivation. The cognitive symptoms include the inability to organise an individual's life and effectively work and a reduction of all memory systems, which reflects a similar dysfunction in the brain regions. (Simpson, 2010).

Cognitive disorders in schizophrenic patients

Cognitive deficits are a core feature of schizophrenia ranging from mild to severe across several domains, including attention, memory, working memory, verbal learning, and executive functions. Cognitive deficits are stable throughout the disorder in most patients. (Goldberg et al., 1998)

Patients with schizophrenia develop atrophy of the frontal lobe and temporal lobes, changes in the corpus callosum, and reduced brain size. (Melvyn and Cyrus, 2015).

Aim of the study

The current study aims to provide a test that measures immediate verbal memory with acceptable psychometric properties, which can be applied to schizophrenia patients.

Definition of terms :

Memory is the set of processes involved in encoding information, retention, and recall, which is one of the active cognitive functions. (Tatsumi and Watanabe, 2009).

There is more than one type of memory, and it includes:

Sensory memory, short-term memory/working short-term memory, and long-term memory. (Tatsumi and Watanabe, 2009).

Verbal memory is classified under short-term and long-term memory; verbal short-term memory reflects the ability to hold information active in one's mind for a short time, whereas long-term memory is the ability to recall stored verbal information. Verbal memory, whose function is to recall words or verbal information, is divided into two sub-domains of long-term memory: declarative and non-declarative (Tatsumi and Watanabe, 2009)

Logical Memory, immediate verbal memory, is the recall of newly learned verbal information that exceeds short-term memory capacity. (American Psychological Association, 1940).

Previous Studies

- Studies that have focused on the psychometric properties (reliability and validity) of the Wechsler memory scale

Orangi and Atefvahid (2002) conducted a study in Shiraz to assess the Reliability of the Wechsler Memory Scale – revised (WMS-R) in the Iranian version. The study sample consisted of (205) normal people (16-64 years). Ages are divided into four categories. The test-retest reliability coefficient score was (0.28-0.98), which indicates high reliability, and it found that the logical memory subtest was one of the most reliable tests.

Another study by Zon and Cui (2015) reviewed the indicators of Validity and reliability of the WMS– The fourth edition of the Chinese version. The result of the study shows that the reliability coefficient of the Wechsler Memory Scale subtests ranged between (0.67-0.97), and the internal consistency coefficient (0.90).

Kawano and Awata (2012) applied the Japanese version of the WMS-R for the elderly aged (75 years) and above, and the study sample consisted of (50) individuals (27 females and 23 Males) who have not had dementia. They found WMS-R to be reliable and found that the results of the logical memory subtest correlated with age and cultural level.

Lo et al.(2012) verified the reliability indicators of the Wechsler Memory Scale-III. The study sample included (339) women between the ages of (40-79), and the test-retest was applied over two to seven years. The results of the study concluded that the logical memory sub-test is reliable and stable, and the performance of the younger sample was better in verbal and logical subtests.

- Studies that have focused on immediate verbal memory in schizophrenia

Chan and others (2000) evaluated the performance of a sample of acute and chronic schizophrenia in encoding, retention, and recall of words and stories to measure verbal memory. The study sample consisted of (20) individuals diagnosed with acute schizophrenia and (20) diagnosed with chronic schizophrenia.

Patients in both samples showed a deficit in storing verbal information, and the study's results indicated that the duration of the Illness was not a factor in predicting the severity of the cognitive deficit.

Matsui and Sumiyoushi (2007) conducted a comparison study to measure logical memory among people with schizophrenia and healthy people. The Logical Memory (LM) subtest was applied from the WMS -R. The sample consists of (35) schizophrenic patients and (24) healthy people. The results concluded that schizophrenic patients showed a deficit in the organisation of story sequences and a reduction in the retrieval of verbal information. In addition, the schizophrenia sample's scores were lower on the logical memory subtest than the healthy sample.

Manglam and Ram (2017) conducted a study to compare the verbal memory of a sample of people with schizophrenia disorder (first episode) and a sample of healthy people to determine if there is a correlation between positive and negative symptoms and verbal memory among the schizophrenia sample. The study consisted of (60) individuals who suffered from the first episode of schizophrenia and (28) healthy individuals; the logical memory subtest was applied from the Wechsler Memory Scale-III. The study results concluded a reduction in the verbal memory of people with schizophrenia compared to the healthy group. Furthermore, positive symptoms were negatively correlated to the logical memory subtest, while negative symptoms were not related to performance on the verbal memory test.

Problem statement

Schizophrenia affects cognitive abilities, including memory; this study aims to provide a subtest of verbal memory that can be applied to these patients. This subtest will contribute to diagnosing, assessing, and providing research tools. In addition, the study of this subtest will provide an opportunity to study the psychometric properties of the WMS-R as a whole.

Definition of terms

1- Psychometric properties: The field is concerned with the statistical description of data as variables and the definition of relationships between these variables (Keszi, 2010).

2- Validity: The test measures what it was designed to measure and the trait it intended to measure. (Knile, 2000)

3- Reliability: The degree of consistency of the test and how stable the scale is over time (Keszi, 2010).

4- The Logical Memory subtest is the most widely used test for assessing logical memory and consists of two short stories of 25 units. After each story is presented, the individual repeats what they remember as accurately as possible (immediate recall) without giving any clues (Gray, 2003). The score is the total number of units the patient can remember.

5- Chronic schizophrenia: It lasts for long periods and occurs between episodes of psychosis, and its symptoms include social withdrawal, lack of motivation, and lack of activity. (Melvyn and Cyrus, 2015).

6- Acute schizophrenia: It is the active phase of schizophrenia that includes positive symptoms, which include hallucinations, delusions, and disturbances in language and thinking. (Vita and Barlati, 2018)

7- Duration of Illness: the period, by year, during which symptoms of schizophrenia disorder appear.

Method

The study sample consists of three groups: chronic schizophrenia, acute schizophrenia, and healthy comparative group. The acute schizophrenia sample consisted of (50) individuals diagnosed with acute schizophrenia with an average age of (40.10) years, and the chronic schizophrenia sample amounted to (60) individuals diagnosed with chronic schizophrenia with an average age of (48.8) years. The healthy sample is not diagnosed with schizophrenia, addiction, or nervous system disorders. The sample consisted of (100) individuals with an average age of (43.5) years. The healthy sample group matched the clinical groups' demographic characteristics.

Table (1) Characteristics of the schizophrenic sample.

Gender		Duration of Illness	chronic	acute
	Male	Less than two years	0	12
		Two years	0	13
		More than two years but less	15	2

		than 11 years		
		More than 11 years	38	0
	female	Less than two years	0	15
		Two years	0	8
		More than two years but less than 11 years	4	0
		More than 11 years	3	0
			60	50

Tools of the study

Logical Memory of Wechsler Memory Scale-Revised

The Wechsler Memory Scale –revised (WMS-R) is an individually applied clinical tool for assessing memory function in adolescents and adults. The test is intended for diagnosis and evaluation and is used as part of a general neuropsychological examination or any clinical examination of memory (Wechsler, 1987). The Logical Memory subtest was translated into Arabic and back to English. In addition, the names of people, cities, and streets have been replaced with alternatives that suit the Jordanian environment. The scoring index was based on the original manual from the WMS-R, which is the number of units recalled correctly. The total score is out of 50.

Mini-Mental State Examination (MMSE)

It is a tool used to assess mental status and cognition and is usually used to assess cognitive functions (Folstein and Mchugh, 1975), and it is considered easy to apply. It takes 5-10 minutes, and the total score is (30). Several factors may affect the test result, including age, educational level, and gender (Hayek et al., 2018). Hayek et al. (2018) modified the Arabic version of the MMSE. The reliability was (0.89), and the

internal consistency was (0.71). In the current study, the reliability coefficient value through internal consistency of Cronbach alpha was (0.813), and in the split-half method, the reliability value was (0.841).

Procedure

Consents: The necessary official approvals were taken in the places where the Ministry of Health will apply the study tool to facilitate the task of the study, and specialists and doctors agreed to choose the appropriate times.

Test direction: each individual is given the following information, "I am going to read to you a little story of just a few lines, listen carefully, and try to remember it just the way I say it, as close to the same words as you can remember. When I am through, I want you to tell me everything I read to you. You should tell me all you can remember, even if you are not sure. Are you ready?" And after we finished, we said, "Now, what I have read for you, tell me about everything from the beginning".

Results and Discussion

1- What are the validity and reliability indicators of the logical memory subtest from the WMS-R in patients with acute and chronic schizophrenia and healthy people?

Several methods calculated the subtest validity, including:

- Content Validity

The logical memory subtest was translated into Arabic and then back-translated to ensure the accuracy of the translation. The two copies (the original one and the translated one) were sent to six psychologists and psychiatrists to judge and comment on the scale's initial translation. After responding to their comments, the final version of the test was given to a group of psychologists and psychiatrists for their last words about the test.

- Discriminate Validity

The LM subtest was applied to the clinical sample (acute and chronic schizophrenia) and the healthy sample (non-clinical). The results indicated that the LM subtest could differentiate between the clinical sample and the healthy samples' performance, where the clinical sample had a lower performance. This means that the LM subtest of the WMS-R has discriminative validity.

- Construct Validity

The correlation coefficient between the score of each paragraph and the total score for the LM subtest was calculated using the Pearson Correlation coefficient.

There was a significant positive correlation between the scores of each paragraph and the total score of the LM subtest from the WMS-R. The correlation coefficient between the first paragraph (story A) and the total test score was (0.982), which is very high and significant. The correlation coefficient between the first paragraph (story A) and the second paragraph (story B) of LM was significant (0.93). Also, there was a significant positive correlation between the second paragraph (story B) and the total score of (0.98).

These results showed that the revised Logical Memory subtest from the WMS-R has a high level of validity, as apparent in three types of Validity: Content, Construct, and Discriminant Validity. These results are in agreement with the conclusion of the following studies: Zon and Cui (2015), Moore and Baker (1997), and Organi and Atefvahid (2002).

Several methods verified the LM subtest reliability:

- The internal consistency coefficient of Cronbach alpha, the split-half method, and the test-retest interval of two weeks were calculated as shown in Table 2.

Table (2) reliability coefficient

Cronbach alpha	Split half	Test-retest
0.964	0.966	0.966

These values indicate the high reliability of the logical memory subtest.

The study results showed that the LM subtest has high and acceptable reliability. These results are in agreement with the conclusion of the following studies (Zon and Cui, 2015; Lo et al. (2012); Organi and Atefvahid (2002); Moore and Baker (1997).

2- Are there significant differences at the level of ($\alpha \leq 0.05$) between healthy people and the clinical sample of acute and chronic schizophrenia on the LM subtest from the WMS-R?

One-way analysis of variance (ANOVA) was used to examine the significance of differences in the average

answers of the samples. The results are shown in Table (3)

Table (3) Results of ANOVA analysis

Source of Variation	Sum squares	DF	Mean Squares	F	Level of significant
Between Groups	20258.442	2	10129.221	244.726	0.000*
Within Groups	8567.753	207	41.390		
Total	28826.195	209			

As is seen in Table (3), there were significant differences between the means of the study groups.

The post hoc test, Scheffe's test, was used to examine further the difference between the groups' means Table (4).

There were significant differences at the level of ($\alpha \leq 0.05$) between patients with acute schizophrenia and the healthy group, the mean (33), which is higher than the mean of those with acute schizophrenia disorder, which was (12).

Table (4): Means (M) and Standard Deviation (SD) of samples

Samples	(M)	(SD)
Acute schizophrenia	12	7
Chronic schizophrenia	14	8
Healthy group	33	5

Also, there are significant differences at the level of ($\alpha \leq 0.05$) between the patients with chronic schizophrenia disorder and among the healthy group; the mean of the healthy sample was (33), which is

higher than the mean for chronic schizophrenia, which was (14). Furthermore, it was also found that there were statistically significant differences at the level of ($\alpha \leq 0.05$) between those with acute schizophrenia disorder and those with chronic schizophrenia disorder; the mean of chronic schizophrenia was (14) and is higher than the average of chronic schizophrenia, which was (12).

These results indicated that the healthy sample's performance was better than the acute and chronic schizophrenia sample on the LM subtest. This result shows schizophrenic patients show a reduced immediate recall of verbal information, a marked deficit in the memory encoding stage, and impairment in analysing verbal stimuli. This deficit was evident in the performance on the immediate verbal memory subtest. The causes of memory impairment may be due to several factors, such as brain size and cortical thickness of people with schizophrenia (Edgar et al., 2012). In addition, compared to healthy people, there is a dysfunction in the frontal and temporal lobes in people with schizophrenia (Hoff and Kremen, 2003).

This dysfunction can also be explained as people with schizophrenia are affected by the severity of symptoms. The test results showed that acute schizophrenia patients performed less efficiently than the chronic schizophrenia sample, indicating that active-positive and severe symptoms characterise acute schizophrenia patients' symptoms. Therefore, their performance on the verbal memory subtest may be affected more. This is explained by severe symptoms leading to poor performance on the Logical Memory Subtest, which measures immediate verbal memory. These results are in agreement with the conclusion of the following studies: Lesson et al. (2009), Matsui and Sumiyoushi (2007), and Manglam and Ram (2017).

3- Are there significant differences in the performance on the logical memory subtest of the WMS-R among people with acute and chronic schizophrenia disorder due to the duration of Illness (less than two years, two years, more than two years, and less than (11) Years, more than (11) years?

A one-way analysis of variance (ANOVA) was used, considering that the performance of the LM of WMS-R is a dependent variable; Tables (5) and (6) show the means and standard deviations. The results show no significant differences in the performance of the schizophrenic samples on the LM subtest from the WMS-R due to the duration of Illness.

Table (5) ANOVA analysis for the duration of Illness.

Source of Variation	Sum squares	DF	Mean Squares	F	Level of significant
Between Groups	286.473	3	95.491	1.770	0.157
Within Groups	5718.218	106	53.945		
Total	6004.691	109			

Table (6) Means and Standard Deviation according to the duration of Illness

Duration of Illness	Mean	Standard Deviation
Less than two years	8.07	13.85
Two years	7.37	13.24
More than two years and less than 11 years	7.11	15.62
More than 11 years	6.94	11.27

This result can be interpreted as a reduction in the prefrontal cortex and hippocampus associated with a deficit in verbal memory (Cirillo and Seidman, 2003; Kraguljac et al., 2013). In addition, there is a deterioration in the activity of the dorsolateral prefrontal cortex in people with schizophrenia (Glahn et al., 2005). These results are in agreement with the conclusion of the following studies: Amann et al. (2012); Townsend et al. (2002), and Chan et al. (2000).

4- Is there a significant correlation between the Wechsler Scale- revised logical memory subtest and the Mini-Mental Status examination test?

The Pearson Correlation coefficient showed a significant positive correlation between the logical memory subtest and the mini-mental state test. The correlation coefficient between them was (0.673), which is significant at the level of ($\alpha \leq 0.05$), and this means the higher the performance on LM, the higher the performance on MMSET.

This result can be explained by the fact that both tests are valid and valuable tools for assessing cognitive deficits in people with schizophrenia. In addition, the MMSET also helps evaluate several aspects, including orientation and attention, which are symptoms that may deteriorate during the course of the disorder.

Similar results were found in Ferrario et al. (1998) study, which indicated a significant relationship between the MMSET and the LM subtest from the WMS-R.

Conclusion and Recommendation

The results of this study showed that the Logical Memory subtest from the WMS-R has acceptable psychometric properties in Arabic culture. Additional studies are needed with different samples of mental disorders and neurological patients to assess their performance on the Logical Memory subtest from the WMS-R.

Conflict of Interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Reference

1.American Psychiatric Association(2013). Schizophrenia spectrum and other psychotic disorders. Diagnostic and statistical manual of mental disorders (5th ed.).Washington: APA.

2.Amann, B., Gomar, J. J., Ortiz-Gil, J., McKenna, P., Sans-Sansa, B., Sarró, S., Moro, N., Madre, M., Landin-Romero, R., Vieta, E., Goikolea, J. M., Salvador, R., & Pomarol-Clotet, E. (2012). Executive dysfunction and memory impairment in schizoaffective disorder: a comparison with bipolar disorder, schizophrenia and healthy controls. Psychological medicine, 42(10), 2127–2135. https://doi.org/10.1017/S0033291712000104

3.Cannon, T. D., Glahn, D. C., Kim, J., Van Erp, T. G., Karlsgodt, K., Cohen, M. S., Nuechterlein, K. H., Bava, S., & Shirinyan, D. (2005). Dorsolateral prefrontal cortex activity during maintenance and manipulation of information in working memory in patients with schizophrenia. Archive of general psychiatry, 62(10), 1071–1080. https://doi.org/10.1001/archpsyc.62.10.1071

4.Cirillo, M. A., & Seidman, L. J. (2003). Verbal declarative memory dysfunction in schizophrenia: from clinical assessment to genetics and brain mechanisms. Neuropsychology Review, 13(2), 43–77. https://doi.org/10.1023/a:1023870821631

5.Chan, A. S., Kwok, I. C., Chiu, H., Lam, L., Pang, A., & Chow, L. Y. (2000). Memory and organisational strategies in chronic and acute schizophrenic patients. Schizophrenia Research, 41(3), 431–445. https://doi.org/10.1016/s0920-9964(99)00078-x

6.El-Hayeck, R., Baddoura, R., Wehbé, A., Bassil, N., Koussa, S., Abou Khaled, K., Richa, S., Khoury, R., Alameddine, A., & Sellal, F. (2022). An adapted Arabic version of the Test of Nine Images for the illiterate Lebanese population: Validation and preliminary normative data. Journal of the International Neuropsychological Society: JINS, 1–8. Advance online publication. https://doi.org/10.1017/S1355617722000236

7.Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. Journal of psychiatric research, 12(3), 189–198. https://doi.org/10.1016/0022-3956(75)90026-6

8.Ferrario, E., Seccia, L., Massaia, M., Fonte, G., & Molaschi, M. (1998). Mini-mental state examination and Wechsler memory scale subtest of logical memory: Correlation in an over 70-year-old population. Archives of Gerontology and Geriatrics, 26, 175-180. https://doi.org/10.1016/s0167-4943(98)80025-3

9.Goldberg, T. E., Aloia, M. S., Gourovitch, M. L., Missar, D., Pickar, D., & Weinberger, D. R. (1998). Cognitive substrates of thought disorder, I: the semantic system. The American journal of psychiatry, 155(12), 1671–1676. https://doi.org/10.1176/ajp.155.12.1671

10. Groth-Marnat, G., & Wright, A. J. (2016). Handbook of psychological assessment (6th ed.). John Wiley & Sons.

11.Krabbendam, L., & Jolles, J. (2002). The neuropsychology of schizophrenia. In Biological Psychiatry (Vol. 2, pp. 631-647). Wiley.

12.Kraguljac, N., Srivastava, A., & Lahti, A. (2013). Memory deficits in schizophrenia: A selective review of functional magnetic resonance imaging (fMRI) studies. Behavioral Sciences, 3(3), 330-347. https://doi.org/10.3390/bs3030330

13.Leeson, V. C., Robbins, T. W., Franklin, C., Harrison, M., Harrison, I., Ron, M. A., Barnes, T. R., & Joyce, E. M. (2009). Dissociation of long-term verbal memory and fronto-executive impairment in first-episode psychosis. Psychological Medicine, 39(11), 1799-1808. https://doi.org/10.1017/s0033291709005935

14.Lo, A. H., Humphreys, M., Byrne, G. J., & Pachana, N. A. (2012). Test-retest reliability and practice effects of the Wechsler memory Scale-III. Journal of Neuropsychology, 6(2), 212-231. https://doi.org/10.1111/j.1748-6653.2011.02023.x.

15.MATSUI, M., SUMIYOSHI, T., ABE, R., KATO, K., YUUKI, H., & KURACHI, M. (2007). Impairment of story memory organisation in patients with schizophrenia. Psychiatry and Clinical Neurosciences, 61(4), 437-440. https://doi.org/10.1111/j.1440-1819.2007.01675.x

16.Organi.M., Atefvahid,M. and Ashayeri.H(2002). Standardisation of the revised Wechsler memory scale in Shiraz. Iranian Journal of Psychiatry and Clinical Psychology, 7(4), 56-66. http://ijpcp.iums.ac.ir/article-1-257-en.html

17.Simpson, E. H., Kellendonk, C., & Kandel, E. (2010). A possible role for the striatum in the pathogenesis of the cognitive symptoms of schizophrenia. Neuron, 65(5), 585-596. https://doi.org/10.1016/j.neuron.2010.02.01

18.Sumiyoshi T. (2015). Verbal memory. Handbook of experimental pharmacology, 228, 237–247. https://doi.org/10.1007/978-3-319-16522-6_8

19.Townsend, L. A., Norman, R. M., Malla, A. K., Rychlo, A. D., & Ahmed, R. R. (2002). Changes in cognitive functioning following comprehensive treatment for first episode patients with schizophrenia spectrum disorders. Psychiatry Research, 113(1-2), 69-81. https://doi.org/10.1016/s0165-1781(02)00236-6;

20.Wechsler, D. (1987). WMS-R: Wechsler Memory Scale-Revised: Manual. San Antonio, TX: Psychological Corporation.

21.Wechsler, D. (2009). Wechsler memory scale: WMS-IV ; Technical and interpretive manual. San Antonio: Pearson.

22.Vita, A., & Barlati, S. (2018). Recovery from schizophrenia: is it possible? Current opinion in psychiatry, 31(3), 246–255. https://doi.org/10.1097/YCO.0000000000000407