

Standardization of Test Your Memory (TYM) Cognitive Assessment Test in Primary Care Subjects Regarding Their Overall Mental Health Status

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Abstract

Background: Early detection of dementia is proven to be cost effective. Uses of suitable screening tools in primary care can increase dementia detection.

Objective: Creation of an effective algorithm in detecting dementia cases in primary care

Method: 320 participants aged 18-90 attending primary care settings. 200 of them participated in standardization of Test Your Memory instrument (TYM). 120 participated in assessing TYM's ability to discriminate between functional and organic causes of cognitive decline.

TYM was translated and adapted to Greek and was administered in 200 participants along with the Mini Mental State Examination. Patients that scored below the cut of point of 25 in MMSE were assessed by an old age psychiatrists out of them 30 were diagnosed with dementia. These were the sample for assessing TYMs face validity. TYM was scored by different raters in order to test its reliability. The other 120 participants were assessed with TYM as well as Geriatric Depression Scale, Short Anxiety Screening Test, WHO (Five) Well-Being Index.

Results: TYM was quite, reliable; (interaters reliability 0,989), in cut of point 39/40 had sensitivity 71%, specificity 70% and negative predictive value of 86%. For subjects above this cut off point TYMs score for depressed patients, patients with increased stress or low quality of life did not differ statistically from the rest of the sample.

Conclusion: TYM in its current form is a reliable and useful screening tool for early detection of dementia in primary care

Keywords: Test Your Memory; Primary Care; Greece; Depression; Well-being; Stress

Key Messages

- Early dementia detection in primary care is the best way to deal with dementia challenge.
- Use of time saving (eg. Self reported) sensitive and culturally adapted screening tools is the best way to tackle this problem.
- Test Your Memory test in its current version is resilient regarding its overall score to subjects mental health status.

Introduction

Aging is amongst the major challenges of the near future. It is estimated that till 2020 there will be a rise from today's 20% to 26% regarding the population of individuals over 60 years old in all country members of the EU [1].

Greece faces a huge problem since it is included amongst the countries with very high life expectancy at birth and one of the lowest birth rates in Europe as well [2].

Cognitive function constitutes very important factor regarding quality of life of elderly individuals, as it is connected with the successful correspondence in daily activities. Due to fact that some degree of cognitive decline is expected in the elderly and it is culturally acceptable, in many cases true incidences of dementia of any kind are neglected and are detected when the optimal time for intervention is lost [3].

Further more complains regarding memory that are made by elderly individuals suffering from other conditions such as depression, stress or other sociopsychological issues like poor quality of life tend to be regarded as early dementia signs reducing even more the accuracy of dementia detection [4].

Cognitive assessment and primary care

Primary care sites are probably the most appropriate service where dementia can be detected in early stages. Use of user-friendly, reliable and culturally appropriate assessment instruments of cognition helps to alleviate the problem of limited time that primary care physicians often experience. Unfortunately such tools are seldom used in Greek primary care settings. Furthermore due to poor training they are not used properly decreasing even more their validity [5].

It is also a fact that primary care settings deal often with patients that demonstrate mild cognitive deficits that is even more difficult to detect. This makes necessary the use of a tool with increased sensitivity even in mild cognitive decline and also to be resilient enough to possible functional causes of it.

The tool that was considered best fitted to the above-mentioned requirements was Test Your Memory (TYM) test. We contacted the manufacturers of the tool. With their approval and aid in certain stages of the adaptation procedure we completed the standardization of this tool in Greek language. After standardization procedure was completed the standardized instrument was further tested in Primary Care setting to assess its usefulness and validity in naturalistic conditions.

Before performing any testing a permission was also granted by Democritus University of Thrace ethics comity.

Methods

The test your memory test

The TYM is a series of 11 tasks on a double-sided sheet of paper with spaces for the patient to fill in. The tasks are: orientation, ability to copy a sentence, semantic knowledge, calculation, verbal fluency, similarities, naming, visuospatial abilities, and recall of a copied sentence, patient's ability to complete the test [6].

Translation and adaptation

A doctor who had perfect knowledge of the English language translated the original tool in Greek; tool format was also copied including coloring. Then there was a separate translation of the tool by another doctor with perfect knowledge of English language that had lived in UK for enough time to be culturally sensitive. Then there was a back translation to English and after minor further adjustments a preliminary text was finalized.

This primary text was administered in a focus group of about ten elderly patients. There were some problems in fraise and in dots connection. With the help the tool manufactures these problems were adressed.

We preferred a fraise with seven items instead of six in the original test. That was judged more culturally relevant to Greek population and was culturally closer to the original text in terms of cultural penetration. Also the letter that was expected to form through dots connections changed from small letter omega in Greek to capital letter mi (M) that was almost identical to English w if it is reversed.

Testing in primary care

Conditions such stress, depression or decline in quality of life for any reason occur frequently in primary care settings. According to literature MMSE seems to be more sensitive to these conditions reducing its usefulness as a screening tool [7]. In order to test TYMs ability to remain relative unaffected from the above mentioned conditions we applied the standardized form of TYM to individuals in primary care settings that scored high in stress and depression and low in quality of life.

Participants

TYM standardization

Both patients and controls were primary care users. They were recruited from meeting places for elderly people and from primary care clinics. We tested 200 subjects 49 males 161 females from 18 to 90 years old. We excluded people with a history of neurological disease, known memory problems or brain injury. All participants gave informed consent.

The aim of this study was to improve dementia screening, so sample was selected from subjects with a mini mental score below 25. This is a fair point for cognitive decline in Greek population since the latest studies regarding Greek MMSE practically placed the cut off point higher than 23/24 that previously was [8].

These cases were further assessed by an Old Age Psychiatry Consultant from Old Age Psychiatry Clinic of Democritus University of Thrace. Out these cases 30 were diagnosed as suffering by some form of Dementia in various stages. These cases were our study's subjects order to test TYM's face validity.

Subjects with the similar demographic characteristics with sample subjects regarding age and sex but with normal mini mental score were matched with the sample group in a ratio 2 for sample group 5 for controls for validity tests.

The rest of controls were people younger than 60 years old so that validity of TYM in different age groups to be tested also.

TYM testing

One hundred and twenty primary care users 30 men and 90 women with a mean age of 68,1 years old (s.d 9,1) that they attended a primary care setting during a certain period were assessed during the testing procedure.

Procedure

TYM standardization

Raters visited for a period of 10 months, in different days of the week elderly meeting places as well as primary care clinics. They interviewed every one above the age of 60 that was not excluded according to our exclusion criteria and was also accepting to participate.

During the last months of the sampling procedure a number of younger controls were also recruited.

Each subject was first answering an ad hoc made questionnaire regarding some demographic data as well as their medical history. They were completing then TYM and finally Mini Mental State Examination Test in its Greek version [9].

After completing TYM tests were photocopied and were scored separately by three doctors. A Consultant in Old Age Psychiatry, a General Practitioner trainee in her final year of training, and a General Practitioner trainee candidate.

All subjects were informed in advance regarding the nature of this research and all of them signed an inform consent document that was approved from Democritus University of Thrace ethics comity.

TYM testing: All testing participants were administered TYM in the standardized version concurrently with, Geriatric Depression Scale (GDS), Short Anxiety Screening Test (SAST), WHO (Five) Well-Being Index (WHO-5). All the above-mentioned tests are translated and standardized for the Greek population [10-12].

Results

TYM Reliability

Controls and patients filled in TYM quickly and efficiently with minimal supervision from the researchers. The average time for controls to complete the test was 10 minutes.

The value of cronbach's a for all participants and subsets was 0.7451. The average TYM score was about 46, 31 for ages 18-69. Above the age of 69, there was a significant decline in performance with an average of 38,81 (Figure 1).

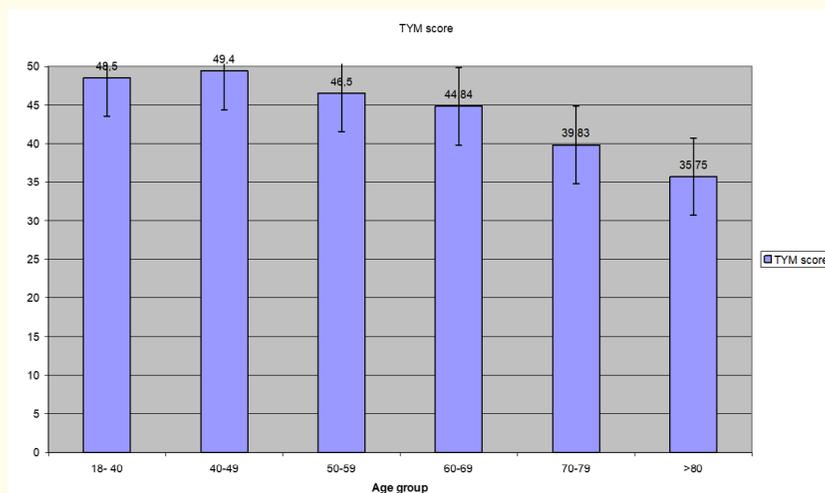


Figure 1: Test Your Memory score in different age groups.

One way analysis of variance confirmed a significant effect of age group on total TYM score ($F = 8,9, P < 0,000$) and showed a significant effect of age on the subs scores: for orientation ($F = 4,8, P < 0,003$), calculation ($F = 3,791, P = 0,012$), visuospatial 1 ($F = 7,032, P = 0,013$), visuospatial 2 ($F = 5,271, P = 0,002$) anterograde memory ($F = 7,032, P < 0,000$), and help required ($F = 2,861, P = 0,040$). Sub scores were in general declining by age.

Men and women didn't differ regarding there age and TYM score. Males 60 years, famales 62,8 years ($p = 0,449$), TYM score was 42.5 for males 43,6 for females ($p = 0,605$).

TYM Validation

Thirty out of 200 participants were judged as suffering from Dementia the mean age o of these patients were 69,7 (Table 1). Comparisons between the total TYM score and subscores for subjects and controls are shown in table 2. Controls age was 73,2 (sd 4,7) subjects age was 74,5 (sd 6,9) there was no significant difference in age between the two groups. Subjects scored poorly on antegrade memory, on semantic knowledge, fluency, visuospatial tasks, similarities, and executive help.

Mean (SD) Raw Score	
Tym (total)	34,53(10,66)
MMSE	22,33(3,33)

Table 1: Mean TYM score vs mean MMSE score of subjects.

Subscore(Maximum)	Controls	Patients	P value
tym demographics	9,18(1,05)	9,21(1,47)	,919
tym sentence	1,63(,78)	1,29(,91)	,099
tym information	2,66(,78)	2,63(,77)	,853
tym calculation	3,23(1,14)	2,50(1,41)	,017
tym fluency	3,43(1,04)	2,67(1,31)	,007
tym similarities	3,70(,89)	3,67(,96)	,894
tym picture	4,54(1,17)	4,08(1,82)	,188
tym letter	1,75(1,18)	1,42(1,28)	,263
tym clock	2,93(1,41)	2,71(1,4)	,527
tym recall	4,20(2,65)	3,42(2,81)	,239
tym help	4,25(1,13)	3,08(1,5)	,000
tym score	41,46(7,83)	36,67(8,27)	,016

Table 2: Comparison of performance on TYM between patients and age matched controls.

Sensitivity and specificity were tested for various cut off points of TYM. They rage from sensitivity at 88% for a score 41/42 and specificity 55% for the same scores, to sensitivity 71% and specificity 70% for a score of 39/40 Negative predictive values, positive predictive values, likelihood ratio for positive result was and likelihood ratio for negative result were also calculated (Table 3).

Score	Sensitivity (%)	Specificity (%)	Positive Predictive Value(%)	Negative Predictive Value(%)	Likelihood Ratio For Positive Result	Likelihood Ratio For Negative Result
39	71	70	49	86	2,36	0,41
40	83	60	46	90	2,07	0,28
41	88	58	46	92	2,09	0,21
42	88	55	46	91	1,95	0,21
43	96	48	42	96	1,84	0,07

Table 3: Psychometric properties of TYM in various cut off points.

Sensitivity and specificity was further investigated using ROC CURVE test. It was found that for a cut off of 23 in Mini Mental state examination a score of 38/39 in TYM sensitivity was 67% while specificity was 77% with area under the curve, 264 (Figure 2).

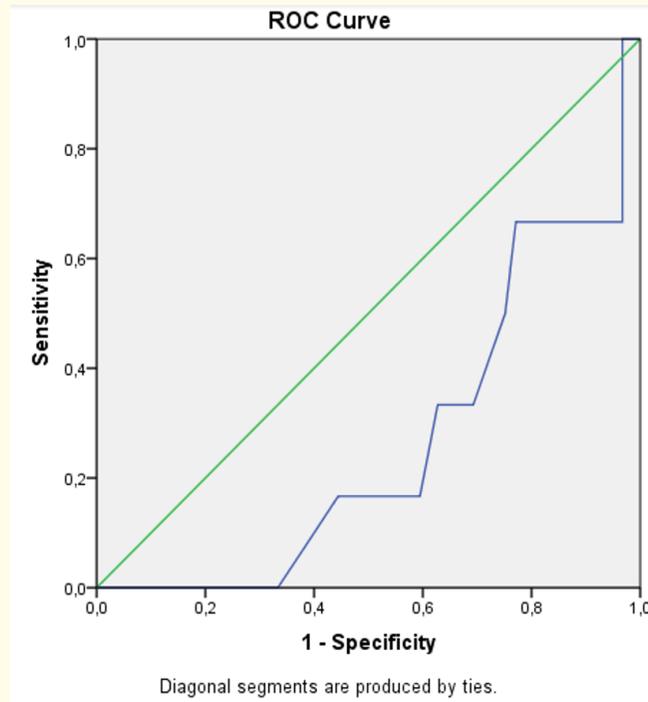


Figure 2: Roc Curve for cutoff point of 23/24 in MMSE.

Three individuals scored the same 200 TYM sheets using the scoring sheet. One was a Psychiatrist experienced in the diagnosis of dementia a General Practitioner in her final year of training and a General Practitioner trainee candidate. Tests were scored independently. Their results were almost identical (Table 4).

Rater	Mean(SD) Raw Score	Consultant	Rater2	Rater1
Consultant	41.54(9,4)			,977
Rater 1	42.4 (8,41)		,978	
Rater 2	41.96 (8,6)	,989		

Table 4: Interrater Correlation of TYM.

Primary care testing

TYM score of Dementia diagnosed subjects was 36,36 and was significantly different in comparison with the TYM score of the rest of the population where it was 46,1 (p =,000).

From the rest of the sample, 9,1% was classified as depressed and their **TYM score** was 45,8 vs TYM score 47,7 for the non depressed (p = ,123), 5,9% were classified as having increased stress and they scored 47,33 in TYM vs 47,55 of those that were not classified as such (p = ,851) and 12,5% were classified as having lower quality of life and they scored in TYM 46,58 vs 47,66 for the rest of the sample (p = ,238) (Table 5).

	Total Sample			Excluding TYM below 39/40		
	Cases (TYM score)	Non Cases (TYM score)	p	Cases (TYM score)	Non Cases (TYM score)	p
Geriatric Depression Scale	106(46,46)	14(36,21)	,000	99 (47,7)	9 (45,78)	,123
Short Anxiety Screening Test	113 (47,55)	6(47,33)	,533	102(47,55)	6 (47,33)	,851
Well-Being Index (WHO-5)	103 (46,23)	16(41,38)	,010	96(47,66)	12(46,58)	,238

Table 5: Results of primary care test of TYM.

Discussion

TYM has 10 different cognitive domains including anterograde memory, semantic knowledge and visuospatial skills, which are typically affected early in Alzheimer’s disease. GPs can use it to detect cognitive deficits in early stages and potentially buy their patients valuable time for treatment by directing them to specialists. It is a self-report test and it only takes 10 minutes, this is very convenient for general practitioners who only have a few minutes at their disposal to examine every patient [13].

It is also quite useful in detecting either mixed type dementia or other non Alzheimer dementias like vascular dementia. This is due to the fact that test is assessing equally various cognitive domains [14].

In its Greek version it is proved quite reliable. Since it’s scoring did not differ from untrained doctors to consultant. This is quite important if you take in to account the difficulties in General Parishioners training.

Its validity is also tested in three ways. First across various age groups were it was proved that it is valid for Greek population since its scores described in average normal age decline of cognitive functions. Abrupt decline of its scores in the oldest age groups is mainly due to the fact that they included, as it was expected people with dementia.

The other way to assess its validity was to compare it with Mini Mental State examination scoring. Sensitivity and specificity of the test was calculated for various cut off points. In total the psychometric properties for the current Greek version of TYM were very close to the original test. At cut off point 39/40 TYM has a sensitivity of 71% and a specificity of 70% as well as a negative predictive value of 86%.

The validity of the test was further assessed with ROC CURVE testing. We choose a cutoff point of 23 for this test. This cut off point was chosen since it is the cut off point for dementia screening in Greek Mini mental test. Its validity was fair in cut off point 38/39 since it showed a sensitivity of 67% and a specificity of 77%. Although its sensitivity was a bit low for a screening its specificity was good.

The third way to check TYM was its resilience to functional causes that can affect cognition such as depression or other sources of stress. TYM's score did not differ between people with depression, stress or low life quality and normal subjects.

Regarding the rest that were scoring both low in TYM and above cut off point for WHO 5 or GDS we must always keep in mind comorbidity of dementia with depression as well as the decline of life quality that cognitive decline can cause. So it would not be normal if there were no cases with depression or low life quality in the sample with low TYM score. To our view this finding adds to the validity of our study [15,16].

We opted not to use more complex statistic tests like factor analysis or multiple regression in order to test the effect of mood stress and well being in TYM scores. The main reason for it was the limited number of variables we tested for and could affect the overall test performance and those were the three psychometric test of GDS, SAST and WHO-5, so there was not a significant need for further reduction of the possible factors on the contrary we aimed to assess the effect of each factor in the TYM score.

Overall though TYM proved to be resilient enough in assessing cognitive decline and although not completely accurate the results seems promising in tackling the over diagnosis of dementia in patients complaining for memory problems in primary care settings.

Regarding TYM overall score had a statistical difference between sample and controls. But what is interesting here is the fact that the ability of the test to assess given help was the most striking difference. Since this is the norm during MMSE use in Greek clinics the ability to measure that seems quite important.

We believe that these psychometric characteristics make TYM a suitable screening and follow up test.

This study had some limitations. Participants were screened for a history of memory problems and neurological disease but not for vascular disease. We do not believe that this actually alters the results because TYM is a screening not a diagnostic test aiming to screen for organic cognitive problems and to increase the percentage to referrals to the specialists.

The other issue was the limited number of Dementia patients. Although their total percentage of people suffering from dementia was in accordance with the literature their overall number of 30 was relatively small [17]. It was difficult when a screening test is used in General population to achieve a great number of cases. Furthermore statistical analysis was performed without problems of validity regarding results.

Conclusions

The current Greek version of TYM is well suited for use in primary care. It is easy to use. It requires minimum training. It has special cultural properties like help assessment, it is also well culturally adapted and it has good screening psychometric characteristics. Furthermore it is resilient enough to cognitive decline due to functional disorders or overall stress reducing overdiagnosis of dementia. So it can offer much in Greek primary care assessment of cognitive deficits representing a significant improvement in comparison with Mini Mental State Examination that is in theory at least the standard used test.

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