Health & Research Journal

Vol 8, No 3 (2022)

Volume 8 Issue 3 July - September 2022

Translation and preliminary validation of the Modified Mini Mental State [3MS] in a Greek sample

Georgios N Lyrakos, Georgia Nikolaidou, Apostolia Alizioti, Paraskevi Matsota

doi: 10.12681/healthresj.27991

To cite this article:

Lyrakos, G. N., Nikolaidou, G., Alizioti, A., & Matsota, P. (2022). Translation and preliminary validation of the Modified Mini Mental State [3MS] in a Greek sample. *Health & Research Journal*, *8*(3), 179–187. https://doi.org/10.12681/healthresj.27991

HEALTH AND RESEARCH JOURNAL
E-ISSN:2459-3192

(2022), Volume 8, Issue 3

RESEARCH ARTICLE

TRANSLATION AND PRELIMINARY VALIDATION OF THE MODIFIED MINI MENTAL STATE [3MS] IN A GREEK SAMPLE

Georgios Lyrakos[1], Georgia Nikolaidou[2], Apostolia Alizioti[3], Paraskevi Matsota[1]

1. Professor, City Unity College, Psychology Department and Associate Researcher, Second Department of Anesthesiology, "Attikon Hospital", Medical School, National and Kapodistrian University of Athens, Greece
2. Department of Anesthesiology, "P & A Kyriakou" Children's Hospital, Athens, Greece
3. Lecturer, City Unity College, Psychology Department
4. Professor, Second Department of Anesthesiology, "Attikon Hospital", Medical School, National and Kapodistrian University of Athens, Greece

Abstract

Background: The Modified Mini Mental State (3MS) is the extended version of the original Mini Mental State test with additional items improving the coverage of the remaining cognitive functions of the original version.

Aim: The aim of this pilot study is to translate the Modified Mini Mental State test and assess its psychometric properties, in order to enable the use of 3MS test for Greek speakers.

Method and Material: Independent sample t-test analysis was performed to test for differences between the study groups (N=105) and dependent sample (N=37), while pair sample t-test for pre-post differences in the treatment group for the 3MS.

Results: Cronbach's a was 0.867 showing very good internal consistency. Children in the cases group presented significantly lower scores after the tonsil operation as compared to controls revealing good discriminant validity of the measurement. Finally, test-retest scores were shown to be significantly correlated, revealing excellent test-retest reliability of the measurement.

Conclusions: The reliability and validity of the 3MS test is established for the healthy children undergoing routine surgery population.

Keywords: Modified Mini Mental State, children, surgery population, validation, Greek.

Corresponding Author: Lyrakos Georgios, D. Mandouvalou 3, Nikaia 18454 , Athens Greece, Email: geolyr@hotmail.com, Phone: 00306906928477.

Cite as: Lyrakos, G., Nikolaidou, G., Alizioti, A., Matsota, P. (2022). Translation and preliminary validation of the Modified Mini Mental State [3MS] in a Greek sample. Health and Research Journal,8(3),179-187. https://ejournals.epublishing.ekt.gr/index.php/HealthResJ

INTRODUCTION

Originally intended to test dementia, the Modified Mini Mental State [3MS],[1] is the extended version of the original Mini Mental State test [MMS]. [2] Both instruments are widely used to assess the occurrence of cognitive difficulties and change over time, including temporal and spatial registration, calculation, attention, recall, language, constructional praxis, as well as time and place orientation. In comparison to the Mini Mental State test, the 3MS includes 4 additional items, adding abstract thinking and delayed memory, as well as improving the coverage of the remaining cognitive functions of the original version. Also, the 3MS has added difficulty, and an extended scores scale from 0-30 to 0-100, ameliorating possible low/high ceiling effects, and enhancing specificity and sensitivity.

Another important difference between the two tests is that the 3MS test is accompanied with grading instructions in greater detail, available for the examiners. Improved instructions in 3MS address observed grading variations and inconsistency with the original MMS, as for example with the evaluation of the responses to the item "world", when tested individuals are asked to spell the word world, and then examiners also need to evaluate and score the process of spelling the word "world" backwards. Also, the improved standardised directions are particularly useful in assessing young children and variable performances that characterise young children.[3]

The 3MS is also the most used test for assessment of Post-Operative Cognitive Dysfunction.[4] Post-Operative Cognitive Dysfunction (POCD) is defined as disturbances in cognitive function that appear after a surgery and general anaesthesia.[5] POCD may persist for days, weeks or months post-surgery with unpredicted consequences for the patient's health, social well - being, and professional or academic life.[6-8]

With a start from animal research that suggests deleterious effects and apoptotic neurodegeneration after general anaesthesia (GA) to rodents,[9] but also studies on post-operative cognitive disturbance observed in toddlers, there has been a growing body of research investigating whether GA has a significant negative effect on children's cognitive function and post-operation academic development.[6,10] For example, one cohort study reports significant differences between exposed and unexposed to GA children's scores in receptive language, expressive language and abstract thinking. In particular, children exposed to GA before the age of 3 were found with a greater than two-fold risk of sustaining receptive and receptive language difficulties at the age of 10, as compared to unexposed children in the cohort, and also with an increased risk of difficulty in abstract thinking.[11] In parallel, there is a growing body of research that examines the impact of surgery and GA on elderly patients, who are also at risk of suffering POCD, especially if they experience pre-operation cognitive difficulties or dementia.[12]

Unfortunately, the methodological differences across the existing studies, as well as scarcity of inclusion of control groups tested in the available studies, does not allow meta-analytical research to develop and therefore findings of studies on POCD are inconclusive.[13] Also, inconclusive is evidence for the post-surgery outcome differences between general and regional anaesthesia, however, research findings suggest that outcome depends on the age and the clinical severity of patients undergoing the surgery, rather than the type of anaesthesia *per se*,[14-17] although there is a lot of room for studies' methodological improvement.[4, 17-18]

Specifically, research evidence suggests that the most possible contributing factors for the development of POCD are age of the patients undergoing an operation (<3 years old and > 60 years old), the surgery-induced inflammation and possibly caused apoptotic neurodegeneration due to anaesthesia,[19-20] pre-operation cognitive function, as well as the presence of depressive symptomatology.[12,21] Moreover, it is suggested that in older patients another contributing factor might be the level of education,[12,20] with estimates of approximately 10% risk decrease for every additional year of education, and 70% risk increase among individuals with high school education, as compared to patients with higher education.[19-20]

In either case, and irrespectively of how low is the percentage

of patients that are found to be encountering POCD symptoms in variant studies, what is definite is that POCD is a condition that requires research and medical attention, as it surely affects a proportion of patients, who firstly need to be informed about POCD, and protected from POCD persistence and the unpredictable consequences, for their safety, health and well-being. Cognitive assessment of patients post-operatively is essential for their recovery and well-being. The aim of this pilot study is to translate the Modified Mini Mental State test and assess its psychometric properties, in order to enable the use of 3MS test for Greek speakers. Pre-operative preparation of patients is, also, important, especially of children and patients encountering severe health problems; addressing individuals' anxiety and emotional state preoperatively.[22-25]

METHODOLOGY

This is a preliminary pre-post study with one treatment and one control group. The study's protocol was approved by the Ethics and Research Committee (AN 24/3/15) and (AN 293/12.01.2015),. The study's report is written in accordance to the guidelines of the template for intervention description and replication (TIDieR), [26] where applicable.

Participants and settings

Totally, 145 school students from first grade of elementary to second grade of high school were recruited, of which 108 had tonsil surgery and 37 were controls. The inclusion criteria were specified as follow: (1) school-age children undergoing tonsil surgery, (2) with no underlying health condition, (3) with no diagnosis of intellectual disability, (4) with no diagnosis of any psychopathology, (5) native Greek speakers. In-person briefing, collection of parental consent forms and questionnaires' collection took place at the premises of the otolaryngologic clinic (treatment group), and at numerous Greek public schools of Attica (control group).

Procedure

Parental informed consent was obtained from the parents of all children that participated in this study. Participation was voluntary; no financial or other incentives were given. All parents were given the study's information sheet and were fully informed for the procedures upfront, including the aim of the study, the description of the mini mental instrument, and the timing of the two measurements. The parent of the children in the treatment group were approached while they were waiting in the children's rooms. The children in the control group were given the study's information sheet to take at home with the contact details in order to arrange assessment's appointments for those parents that gave their consent. The children of the treatment group undertook the 3MS test at their hospital room, one day before the surgery, and tested again right after the operation, at the recovery room. The children of the control group were tested at a quiet room of their school. 3MS test was administered by the researchers of the study, and took approximately 10 minutes.

Measures

The 3MS is a 15-item test with answering duration of 5 to 10 minutes. One-month test - retest stability coefficient is reported to be .80, whereas cutting-off points are regularly between 76 and 80.[1] Test-retest stability and sensitivity of the 3MS makes this test appropriate for detection of cognitive change over subsequent assessments in time, which is especially useful in evaluating patients' progress in rehabilitation programs. Since it is more important to effectively identify individuals, children or adults, who sustain cognitive disturbances, even if false positives might increase, sensitivity is often preferred over specificity, and therefore various studies have calculated optimal sensitivity cut-off points. In elderly and young children, scores in cognitive abilities tests, and specifically in 3MS, are strongly associated with age and education, as well as with possible interaction between age and education.[27-28] For example, the study of Grace and colleagues, 1994 in geriatric population with occurrence of stroke, reported optimal cut-off point to be 86 of 100, with resulting sensitivity 94% and specificity 50%. In children population however, cut-off 87 is sug-

gested only for the age of 9 and older.[3]

The New Greek version of the questionnaire was initiated after contacting the developer of the instrument and informing them about the purpose of the study.

The translation strategy was created on minimal criteria established by the Scientific

Advisory Committee of the Medical Outcomes Trust.[29]

Translation was implemented using the multiple forward and backward translation protocol recommended by Guillemin, Bombardier & Beaton.[30]

A reconciliation meeting was conducted to obtain a consensus version. Then, two native English speakers retranslated the reconciliated Greek version into the source language (back translation) which is the recommended procedure for creating semantic equivalence.[31]

Data analysis

According to the statistical power analysis performed for sample size estimation, with an alpha = .05, β = .2 and power = 0.80, the projected minimum sample size needed is 16 children per group. Absolute and relative frequencies (%) are presented for nominal data, whereas Mean and Standard Deviation are reported for scores. Normal distribution of residuals and linearity was examined with Kolomogorov-Smirnov test and normal probability plots. Independent sample t-test analysis was performed to test for differences between the study groups and dependent sample t-test for pre-post differences in the treatment group. Reliability of Modified Mini-Mental State Examination scores was assessed by calculating Pearson product-moment correlation coefficients between scores obtained on the first and second administration of the test. All statistical analysis was performed using the SPSS v.21. An alpha level of $p < .05$ was used throughout the analysis.

RESULTS

In total 108 children were recruited and completed the pre-post measurement. Sample characteristics are presented in Table 1. Cronbach's a, for this subset at the initial test period was 0.867 showing a very good internal consistency for the measurement. Corrected Item-Total Correlation ranged from 0.179 to 0.721 with all the items having significant correlation with the total score.

Children in the cases group presented a significantly lower scores after the tonsil operation as compared to controls (cases: M=73.5, controls: M=85.5, p=.001) revealing a good discriminant validity of the measurement.

Also, boys after surgery scored significantly lower after the surgery as compared to boys in the control group (cases: 71.6, control: 87.7, p=.001). However, there was no significant differences found between the girl sub-groups and no differences were found between boys and girls in all the subdomains of the questionnaire.

Moreover, there was a statistically positive correlation between total score and age, both for the first and the second administration respectively (r = .747, p = .000; r = .718, p = .000). Also, significant differences were found between all different educational levels, except between kindergarten and 1st class ($F_{8,133}$=21.135, p=.000) as presented in table 2.

Finally, test-retest scores were shown to be significantly correlated (r = .959, p = .000) revealing an excellent test retest reliability of the measurement.

DISCUSSION

This was the first study to explore the psychometric properties of the Greek 3MS questionnaire. Reliability of the Greek version of the Modified Mini-Mental State Examination scores was assessed through test-retest correlation coefficients. Test scores for the Modified Mini-Mental State Examination appear to be reliable for both treatment and control samples in 1week retest interval. The stability of these scores over time provides more meaningful interpretation of results.

As in previous studies with adults,[32- 33] the present study found that children's Modified Mini-Mental State Examination scores are significantly related to both age and education. Taking this into consideration, reported means and standard deviations by age group may therefore be used as a standard against which

a particular child's performance on the measurement can be estimated.

Internal consistency of the measurement was found to be similar to the Canadian study, were alpha was 0.87 for the 3MS revealing a good reliability for the new Greek version of the test.

Previous studies using the Mini-Mental State Examination with adult populations have established that the measurement is able to distinguish between nonclinical and diagnostic groups[2, 34], a result that was replicated in the present study as well, since significant differences were found between children undergoing surgery and the control group. This result is also an addition to the Besson and Labbe results that were unable to reveal significant differences due to the skewed distribution of their sample.[3]

In conclusion the present study was the first to examine the psychometric properties of 3MS in a Greek sample of children that provide data on central tendency and variability of scores at each age level that may be used as preliminary norms. More studies are needed to provide evidence for differences between different clinical samples and cut of scores distinguishing between different clinical conditions both for adults as well children.

Limitations of the study

This study has several limitations. First, the sample was convenient, which means that results cannot be easily generalised. Also, the sample was consisted only of Greek speaking children, thus cultural adaptation should be achieved in second time.

Conclusion

In this study, the reliability and validity of the 3MS test is established for children undergoing routine surgery population.

Acknowledgements

The authors would like to thank all parents and their children that accepted to participate in the present research for their valuable contribution to the validation of the instrument in the Greek language.

REFERENCES

1. Teng E, Chui H. The modified mini-mental state examination (3MS). Can J Psychiatry. 1987 Aug;41(2):114-21.
2. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. Journal of psychiatric research. 1975 Nov 1;12(3):189-98.
3. Besson PS, Labbé EE. Use of the modified mini-mental state examination with children. Journal of child neurology. 1997 Oct;12(7):455-60.
4. Mason SE, Noel-Storr A, Ritchie CW. The impact of general and regional anesthesia on the incidence of post-operative cognitive dysfunction and post-operative delirium: a systematic review with meta-analysis. Journal of Alzheimer's Disease. 2010 Jan 1;22(s3): 67-79.
5. Ntalouka MP, Arnaoutoglou E, Tzimas P. Postoperative cognitive disorders: an update. Hippokratia. 2018 Oct;22(4):147-54.
6. Aun CS, McBride C, Lee A, Lau AS, Chung RC, Yeung CK, Lai KY, Gin T. Short-term changes in postoperative cognitive function in children aged 5 to 12 years undergoing general anesthesia: a cohort study. Medicine. 2016 Apr;95(14). e3250.
7. Steinmetz J, Christensen KB, Lund T, Lohse N, Rasmussen LS, ISPOCD Group. Long-term consequences of postoperative cognitive dysfunction. The Journal of the American Society of Anesthesiologists. 2009 Mar 1;110(3):548-55.
8. Hogue Jr CW, Fucetola R, Hershey T, Nassief A, Birge S, Dávila-Román VG, Barzilai B, Thomas B, Schechtman KB, Freedland K. The role of postoperative neurocognitive dysfunction on quality of life for postmenopausal women 6 months after cardiac surgery. Anesthesia and analgesia. 2008 Jul;107(1):21.
9. Bercker S, Bert B, Bittigau P, Felderhoff-Müser U, Bührer C, Ikonomidou C, Weise M, Kaisers UX, Kerner T. Neuro-

degeneration in newborn rats following propofol and sevoflurane anesthesia. Neurotoxicity research. 2009 Aug;16(2):140-7.

10. Ing C, DiMaggio C, Whitehouse A, Hegarty MK, Brady J, von Ungern-Sternberg BS, Davidson A, Wood AJ, Li G, Sun LS. Long-term differences in language and cognitive function after childhood exposure to anesthesia. Pediatrics. 2012 Sep 1;130(3):e476-85.
11. Ing C, Wall MM, DiMaggio CJ, Whitehouse AJ, Hegarty MK, Sun M, von Ungern-Sternberg BS, Li G, Sun LS. Latent class analysis of neurodevelopmental deficit after exposure to anesthesia in early childhood. Journal of neurosurgical anesthesiology. 2017 Jul;29(3):264.
12. Ancelin ML, De Roquefeuil G, Ledésert B, Bonnel F, Cheminal JC, Ritchie K. Exposure to anaesthetic agents, cognitive functioning and depressive symptomatology in the elderly. The British Journal of Psychiatry. 2001 Apr;178(4):360-6.
13. Hanning CD. Postoperative cognitive dysfunction. British journal of anaesthesia. 2005 Jul 1;95(1):82-7.
14. Khetarpal R, Bali K, Chatrath V, Bansal D. Anesthetic considerations in the patients of chronic obstructive pulmonary disease undergoing laparoscopic surgeries. Anesthesia, essays and researches. 2016 Jan;10(1):7.
15. Rasmussen LS. Postoperative cognitive dysfunction: incidence and prevention. Best practice & research Clinical anaesthesiology. 2006 Jun 1;20(2):315-30.
16. Wu CL, Hsu W, Richman JM, Raja SN. Postoperative cognitive function as an outcome of regional anesthesia and analgesia. Regional Anesthesia & Pain Medicine. 2004 May 1;29(3):257-68.
17. Patel V, Champaneria R, Dretzke J, Yeung J. Effect of regional versus general anaesthesia on postoperative delirium in elderly patients undergoing surgery for hip fracture: a systematic review. BMJ open. 2018 Dec 1;8(12):e020757.
18. Rasmussen LS, Larsen K, Houx P, Skovgaard LT, Hanning CD, Moller JT, ISPOCD group. The assessment of postoperative cognitive function. Acta Anaesthesiologica Scandinavica. 2001 Mar;45(3):275-89.
19. Feinkohl I., Winterer G., Spies CD, Pischon, T. Cognitive reserve and the risk of postoperative cognitive dysfunction. Deutsches Arzteblatt international. 2017 114(7):110-7.
20. Moller JT, Cluitmans P, Rasmussen LS, Houx P, Rasmussen H, Canet J, Rabbitt P, Jolles J, Larsen K, Hanning CD, Langeron O. Long-term postoperative cognitive dysfunction in the elderly: ISPOCD1 study. The Lancet. 1998 Mar 21;351(9106):857-61.
21. Feinkohl I, Winterer G, Spies CD, Pischon T. Cognitive reserve and the risk of postoperative cognitive dysfunction: a systematic review and meta-analysis. Deutsches Ärzteblatt International. 2017 Feb;114(7):110-4.
22. Kain ZN, Mayes LC, Caldwell-Andrews AA, Karas DE, McClain BC. Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery. Pediatrics. 2006 Aug 1;118(2):651-8.
23. Kar SK, Ganguly T, Dasgupta CS, Goswami A. Preoperative Anxiety in Pediatric Population: Anesthes. Translational biomedicine. 2015 Oct 1;6(4):1-9.
24. Perry JN, Hooper VD, Masiongale J. Reduction of preoperative anxiety in pediatric surgery patients using age-appropriate teaching interventions. Journal of PeriAnesthesia Nursing. 2012 Apr 1;27(2):69-81. doi: 10.1016/j.jopan.2012.01.003
25. Du J, Plas M, Absalom AR, van Leeuwen BL, de Bock GH. The association of preoperative anxiety and depression with neurocognitive disorder following oncological surgery. Journal of surgical oncology. 2020 Mar;121(4):676-87.
26. Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, Altman DG, Barbour V, Macdonald H, Johnston M, Lamb SE. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. Bmj. 2014 Mar 7;348.
27. Bravo G, Hébert R. Age- and education-specific reference values for the Mini-Mental and modified Mini-Mental State Examinations derived from a non-demented elderly

population. Int J Geriatr Psychiatry. 1997 Oct;12(10):1008-18

28. Ouvrier RA, Goldsmith RF, Ouvrier S, Williams IC. The value of the Mini-Mental State Examination in childhood: a preliminary study. Journal of child neurology. 1993 Apr;8(2):145-8.
29. Trust MO. Trust introduces new translation criteria. Medical Outcomes Trust Bulletin. 1997;5(1):3-4.
30. Guillemin F. Cross-cultural adaptation and validation of heatth status measures. Scandinavian journal of rheumatology. 1995 Jan 1;24(2):61-3.
31. Benet V, Waller NG. The Big Seven factor model of personality description: Evidence for its cross-cultural generality in a Spanish sample. Journal of Personality and Social Psychology. 1995 Oct;69(4):701.
32. Franzen MD, Berg RA. Screening children for brain impairment. 2nd ed. New York: Springer Publishing Company; c1998. 298 p.
33. Holzer CE, Tischler GL, Leaf PJ, Myers JK. An epidemiologic assessment of cognitive impairment in a community population. Research in Community & Mental Health. 1984;4: 3-32.
34. Taylor MA, Abrams R. Cognitive impairment in schizophrenia. The American journal of psychiatry. 1984 Feb.

ANNEX

TABLE 1. Sample characteristics.

		Total N(%)	Controls N(%)	Cases N(%)
Study group				
Controls		37(25,5%)	-	-
Cases		108(74,5%)	-	-
Sex				
Boys		72(50,3%)	17(48,6%)	55(50,9%)
Girls		71(49,7%)	18(51,4%)	53(49,1%)
Grade				
Pre-school		4(2,8%)	0(0,0%)	4(3,7%)
Elementary	1st	33(23,2%)	5(14,3%)	28(26,2%)
	2nd	22(15,5%)	2(5,7%)	20(18,7%)
	3rd	25(17,6%)	5(14,3%)	20(18,7%)
	4th	13(9,2%)	2(5,7%)	11(10,3%)
	5th	17(12,0%)	6(17,1%)	11(10,3%)
	6th	15(10,6%)	8(22,9%)	7(6,5%)
Secondary	1st	11(7,7%)	7(20,0%)	4(3,7%)
	2nd	2(1,4%)	0(0,0%)	2(1,9%)

TABLE 2. Modified Mini Mental State scores

	Controls *M* (SD)	Cases *M* (SD)	p-value
Mini Mental			
Total	85,5(13,8)	73,5(19,0)	**0,001***
Boys	87,7(13,6)	71,6(20,1)	**0,001***
Girls	85,4(14,8)	75,6(17,7)	0,073
For total sample			
Pre-school	45,0(18.5)		
Elementary 1st	58,6(16.7)		0,157**
2nd	70,2(15.3)		**0,002****
3rd	78,9(11.3)		**0,000****
4th	84,6(13.1)		**0,000****
5th	88,9(7.8)		**0,000****
6th	94,5(4.9)		**0,000****
Secondary 1st	92,5(4.4)		**0,000****
2nd	95,5(2.1)		**0,000****
For cases only			0,102
Mini Mental Pre		73,5(18,9)	
Mini Mental Post		72,6(20,6)	

*For independent sample t test; **for multiple comparison with Dunnet 2-sided test; M: Mean; SD: Standard Deviation