

## Abstract

**Background:** Owing to an ageing population, dementia has become a major health and economic challenge in Hong Kong. Alzheimer's disease (AD) is the most common type of dementia. The diagnosis and staging of AD rely mainly on clinical assessment of cognitive and functional impairments. The well-established Mini-Mental State Examination (MMSE) has been widely used as a brief cognitive instrument to screen and stage the severity of dementia. However, it has a ceiling effect with a lower sensitivity in early stages of cognitive impairment and dementia. The use of MMSE also entails a standard fee due to copyright issues. In recent years, the Hong Kong version of Montreal Cognitive Assessment (HK-MoCA) has become increasingly popular as a screening instrument for Mild Cognitive Impairment (MCI) and dementia in Hong Kong, but the applicability of the HK-MoCA as a staging instrument to monitor the progression of dementia remains unknown.

**Aim:** To determine the HK-MoCA cut-off score for mild and moderate, and moderate and severe AD.

**Method:** This is a cross-sectional study, matching the score of HK-MoCA against an established standard, the Chinese version of the Clinical Dementia Rating (C-CDR), for grading the severity of AD. Functional Assessment Staging (FAST), the Chinese version of Neuropsychiatric Inventory (CNPI), the Chinese version of the Zarit Burden Interview (CZBI) and Cumulative Illness Rating Scale for Geriatrics (CIRS-G) were also performed on each participant. One hundred and fifty-five participants with AD were enrolled through convenience sampling in a psychogeriatric specialist outpatient clinic. The assessors for C-CDR, HK-MoCA and FAST were blinded to each other. Thirty-eight participants were invited to perform the HK-MoCA a second time for evaluating inter-rater reliability between two to four weeks later. The cut-off scores of the HK-MoCA for mild and moderate, and

moderate and severe AD were determined by Receiver-operating Characteristic (ROC) analysis. Other correlations analyses were done by Spearman's rho correlation coefficient.

**Results:** The four co-investigators demonstrate good interrater reliability for the HK-MoCA, with overall sign-rank test  $p = 0.109$  and Spearman rho correlation coefficient  $r = 0.949$  and  $p < 0.001$ . Before the adjustment for age and education, the ROC analysis showed that the cut-off score of HK-MoCA for severe and moderate AD was 4/5 with a sensitivity of 84.4%, specificity of 91.9%, and area under the curve (AUC) of 0.942,  $p < 0.001$ . For moderate and mild AD, the cut-off score was 9/10 with a sensitivity of 86.3%, specificity of 93.3% and AUC of 0.953,  $p < 0.001$ . When age and education were taken into account, the cut-off for severe and moderate AD remained at 4/5. But for moderate and mild AD, the cut-off score became 8/9 with a sensitivity of 90.4%, specificity of 95.6% and AUC of 0.961,  $p < 0.001$ . There were no linear correlations between CNPI, CZBI and CIRS-G against the HK-MoCA score or the C-CDR. FAST correlates to both HK-MoCA and C-CDR, with  $r = -0.548$ ,  $p < 0.001$  and  $r = 0.658$ ,  $p < 0.001$  respectively.

**Conclusion:** The HK-MoCA is a reliable and valid instrument to differentiate mild and moderate, and moderate and severe AD patients. The effect of education on the cut-off score of mild and moderate AD will need further research. This study demonstrates that HK-MoCA does have the potential to be an alternative instrument to the MMSE in staging of dementia in AD.

**Keywords:** Alzheimer's disease, Chinese, Clinical Dementia Rating (CDR), Dementia, Hong Kong, Hong Kong version of Montreal Cognitive Assessment (HK-MoCA), Staging, Validation