Development and validation of a composite score as an easy-to-use instrument for clinical monitoring of dementia progression: the Composite Cognitive and ADL Functioning Score

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Running head: Composite Cognitive and ADL Functioning Score

To the editor: Several outcomes are suitable to describe and monitor the progression of disease severity in cognitive disorders and several instruments are available. Often the choice of such instruments is determined by research questions and available data. There are specific instruments to measure cognition (global scales such as MMSE (1) or more extensive neuropsychological assessment batteries), functional abilities (e.g. Katz ADL (2)), behavior (e.g. NeuroPsychiatric Inventory (3)) and quality of life (e.g. QoLAD (4)). However, each instrument measures just one aspect while all of them are relevant to a person with cognitive impairment. Therefore, instruments combining all of these aspects such as the Clinical Dementia Rating (CDR) scale (5) and the Global Deterioration Scale (6) are usually based on clinical judgment. In spite of the validity of these composite measures, the need for clinical expertise to judge each single subject can limit their use in the setting of large population based studies due to time and financial constraints. In addition, some instruments have only a limited scale range (e.g. Global Deterioration Scale has 7 stages), which makes them less suitable to track small changes over time. Therefore, in the Kungsholmen Project (KP) (7) – a longitudinal, population-based study on aging and dementia that followed 1810 persons aged 75 and over for up to 12 years, we developed an alternative composite score combining the MMSE and Katz ADL scores and validated this score against the CDR scale.

The Composite Cognitive and ADL Functioning Score was calculated by averaging the z-scores of the MMSE and the Katz ADL such that a lower score indicated worse functioning. For the MMSE the usual instrument and scoring (range 0-30) was used. With respect to Katz ADL, in KP each of the six Katz ADL items was measured on a three point scale, where “no”, “some”, “much help needed” were assigned 0,1 and 2 respectively. This resulted in the score

range of 0 (no help at all needed) to 12 (much help needed for all of the ADL items). Z-scores were calculated using the means and standard deviations of participants who were not demented at the first follow up (FU) and remained without dementia in the second and third FU (n=573). The resulting composite score was validated against the CDR score, by calculating the correlation between the composite score and CDR of the samples of the first (n[total]=1099, n[demented]=235) and second (n[total]=683, n[demented]=190) FU, and by calculating the correlation of the changes in both scores between the first and the second follow up. Non-demented participants were assigned a CDR score of zero.

The Pearson correlation coefficient between the composite score and CDR was 0.88 at the first FU, 0.83 at the second FU, and was 0.62 for the changes in the scores between the first and second FU. All correlation coefficients were significant at $p < 0.0001$. The composite score interquartile range was [-0.66 – 0.32] for participants assigned CDR=0, [-2.58 – -0.90] for CDR=1, [-5.50 – -2.56] for CDR=2, and [-9.61 – -5.23] for CDR=3.

The results indicated high correlations between the Composite Cognitive and ADL Functioning Score and the CDR score at one point in time. Also changes over time in the composite score correlated highly with the change in CDR. These observations support the validity of the composite score that was developed. The fact that the interquartile ranges of the composite scores per CDR score overlapped little, shows that the composite score could accurately separate CDR categories. This supports the clinical relevance and provides information for the clinical interpretation of the Composite Cognitive and ADL Functioning Score. We conclude that based on the validation by CDR scores in our study population, the Composite Cognitive and ADL Functioning Score is easy to use and interpret, clinically relevant, and

46 as it reduces the need for clinical judgment of each individual required in comparable composite
47 measures, it is highly useful for large population-based studies.

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Elements of Financial/Personal Conflicts	*Author 1: RM		Author 2: SA		Author 3: LF	
	Yes	X No	Yes	X No	Yes	X No
Employment or Affiliation						
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Honoraria						
Speaker Forum						
Consultant						
Stocks						
Royalties						

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