Cognitive-Linguistic Performance & Quality of Life in Healthy Aging

FOFI CONSTANTINIDOU, PH.D., CCC-SLP
PROFESSOR, DEPARTMENT OF PSYCHOLOGY, UNIVERSITY OF CYPRUS

JULIANA PROKOPIOU, M.SC.
DEPARTMENT OF PSYCHOLOGY & CENTER FOR APPLIED NEUROSCIENCE, UNIVERSITY OF CYPRUS

MARIA NIKOU, M.SC.
DEPARTMENT OF PSYCHOLOGY & CENTER FOR APPLIED NEUROSCIENCE, UNIVERSITY OF CYPRUS

SAVVAS PAPACOSTAS, M.D., F.A.A.N.
PROFESSOR, CYPRUS SCHOOL OF MOLECULAR MEDICINE, THE CYPRUS INSTITUTE OF NEUROLOGY & GENETICS

THE CYPRUS INSTITUTE OF NEUROLOGY & GENETICS
CENTER FOR APPLIED NEUROSCIENCE
CYPRUS SCHOOL of molecular medicine
BACKGROUND / AIMS

- Socio-economic, medical and technological improvements have contributed to increased life expectancy.
- There is a need to lead active and productive lives for decades beyond formal retirement.
- In Europe, the percentage of people older than 60 years was 20.3% in 2000 and it is expected to rise to 28.8% by 2025.
- Advanced age is associated with increased prevalence of chronic diseases such as neurological and psychiatric conditions, arthritis, heart problems, hypertension, diabetes, and cancer.
Conditions resulting in loss of language abilities, or reductions in cognitive functioning, such as stroke or dementia, interfere with independence, productivity, well-being, and quality of life.

To investigate the quality of life in relation to cognitive-linguistic performance and demographic characteristics in a large cohort of cognitively healthy older adults.

✓ Age, education, gender
Changing Concepts on Aging

OLD VIEW

• Increased risk of disease and disability with advancing age results from inevitable, intrinsic aging processes, which are mainly genetically determined.

RECENT VIEW

• Aging characteristics are in fact due to lifestyle and other factors and may be potentially be modified.
• Risk factors for the emergence of disease in aging, including cardiovascular and cerebrovascular diseases, can be substantially modified.
• Both unmodifiable factors (e.g., genetic predisposition) and modifiable factors (e.g., life style, social integration, environmental support) can contribute to healthy aging or alternatively shape the risk for disease in old age.
WHO definition of health

• Health is defined not only as the absence of illness but a state of physical, mental and social wellbeing.

• Quality of Life is defined as an individual’s perception of their position in life in the context of the culture and value systems in which they live and in relationship to their goals, expectations and standards.

• The Neurocognitive Study for the Aging investigates several aspects of aging, including neuropsychological-neurocognitive performance, psychosocial factors, biological markers, and quality of life in a large cohort of older Greek Cypriot adults.

• The study aims to identify which cognitive-linguistic aspects of performance are most predictive of increased levels of QoL.
Healthy/Successful Cognitive Aging

- Successful aging consists of three main components:
  - low probability of disease and disease related disability,
  - high cognitive and physical function
    - What a person can do, not what a person does do
  - active engagement with life
    - Two major elements:
      - maintenance of interpersonal/social relations
      - productive activities
Healthy Aging

• Some decline in cognitive performance is noted with progressively older age
• Healthy aging affects primarily executive abilities and memory functioning
• Older adults require extra time to perceive, interpret and execute responses due to reduced speed of processing associated with problem solving abilities
• Education measured in years and quality of cognitive engagement can moderate the effects of aging via the creation of cognitive reserve
Aspects of Quality of Life

- having good health,
- remaining independent,
- having a good income,
- remaining active,
- experiencing happiness,
- family and social relationships,
- good living conditions and neighborhood,
- religion.
Quality of Life in Older Persons

- Social relationships,
- Social roles and activities,
- Solo activities,
- Health,
- Psychological states
- Financial circumstances
- Independence,
- Miscellaneous and society/politics
METHODOLOGY-PARTICIPANTS

- 578 Greek Cypriot persons aged 60 and up to 91 were recruited in the Neurocognitive Study on Aging.
- 87 were excluded due to preexisting neurological conditions such as epilepsy, dementia or significant brain injury.
- 96 were excluded because they scored < 25 on the Mini Mental State Examination.
- 395 participants
  - 171 males; mean age 73.95 (SD = 6.31) and mean years of education 9.46 (SD = 4.50);
  - 224 females; of mean age 71.96 (SD = 6.02) and mean years of education 7.93 (SD = .05).
- Participants were recruited from the community and from social organizations for the elderly from all around Cyprus.
- They resided at home and none of the participants was institutionalized at the time of participation.
- All participants had Greek or Cypriot/Greek as their primary language.
METHODOLOGY-PROCEDURES

- Mini Mental State Examination (MMSE)
- Geriatric Depression Scale (GDS)
- Executive Function Tests
  - Trail Making Tests (TMT) A and B (visual search, scanning, speed of processing, mental flexibility, and executive functions)
  - Symbol Digits Modalities Test (SDMT) (complex scanning and visual tracking)
  - Animal recall and Words from the letter F (Verbal fluency) Modified from COWAT
- Verbal Episodic Memory Tests
  - Greek version of the Logical Memory story A from the Wechsler Memory Scale-R: Immediate and delayed recall of a short story material (version of the HVLT-R)
  - Word learning trials (list learning and delayed recall performance-25min)
• Vocabulary
  • Greek Version of the Peabody Picture Vocabulary Test (PPVT-III)
  • Greek version of the Boston Naming Test-Short Version (BNT)

• Reading measures
  • The total numbers of words and of pseudowords read separately and correctly in 45sec

• Quality of Life
  • QoL was assessed with the self-report questionnaire WHOQOL-BREF, the abbreviated 26 item version of the WHOQOL10
  • Four different domains
    ◦ Physical Health/Activities of daily living
    ◦ Psychological Health
    ◦ Social relationships
    ◦ Environment/ Financial resources
  • A total score for QoL is also obtained from the combination of these 4 domain scores.
The primary statistical design used for the study was a between group design (ANOVA) with three between group factors (age, education, and gender) at $\alpha = .05$.

Preplanned univariate comparisons were followed multivariate findings.

Exploratory descriptive statistics and Pearson correlation analyses ($\alpha$) were conducted to examine relationships between cognitive and language measures and QoL. Followed by sequential regression analysis to test a model predictive of QoL.

The primary design incorporated three factors: age (young-old and old-old groups), education (4 levels) and gender (male and female)
RESULTS

Age, Education, Gender and QOL Performance

- There was an overall group effect on Gender, $p = .001$ and Education, $p = .004$
- Performance on the overall QoL score was not significantly affected by age, $p = .975$.
- The gender by education group, education by gender, and gender by age interactions were not significant ($p>.05$).

Male participants scored higher on QoL measures than their female counterparts.

Pairwise comparisons ($\alpha = .010$) showed that males systematically reported higher scores on the WHOQOL-BREF domains of Physical Health/Activities of daily living; $p = .014$; Psychological Health; $p = .002$; and Environment/Financial resources; $p = .001$; but not Social relationships.
RESULTS

• Pre-planned univariate comparisons (α = .015) were conducted following the significant Education main effects.

• The analyses yielded significant differences between the performance of lowest group and the rest of the three groups $p = .0001$, and between the second and two highest educational groups, $p = .001$.

• There was no difference in the overall QOL performance between the two highest education groups, $p = .925$. 
Mean overall score and mean score on the 4 domains of Quality of life of the WHOQOL-BREF per Age group and per education group, with standard deviation in parentheses.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>QoL Domain</th>
<th>0-4 years</th>
<th>5-9 years</th>
<th>10-12 years</th>
<th>13+ years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (S.D.)</td>
<td>Mean (S.D.)</td>
<td>Mean (S.D.)</td>
<td>Mean (S.D.)</td>
</tr>
<tr>
<td>60-75 (n = 272)</td>
<td>Physical Health</td>
<td>21.21 (16.99)</td>
<td>25.60 (4.57)</td>
<td>28.09 (4.55)</td>
<td>28.20 (3.81)</td>
</tr>
<tr>
<td></td>
<td>Psychological Health</td>
<td>19.46 (2.87)</td>
<td>21.79 (3.01)</td>
<td>23.66 (2.91)</td>
<td>21.64 (7.20)</td>
</tr>
<tr>
<td></td>
<td>Social Relations</td>
<td>10.38 (1.84)</td>
<td>10.78 (1.99)</td>
<td>11.48 (2.00)</td>
<td>11.16 (2.22)</td>
</tr>
<tr>
<td></td>
<td>Environment</td>
<td>28.00 (3.53)</td>
<td>28.03 (4.00)</td>
<td>29.98 (3.72)</td>
<td>29.78 (4.11)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>79.04 (19.38)</strong></td>
<td><strong>86.19 (10.88)</strong></td>
<td><strong>93.21 (10.99)</strong></td>
<td><strong>90.78 (12.58)</strong></td>
</tr>
<tr>
<td>76-92 (n = 123)</td>
<td>Physical Health</td>
<td>24.36 (4.05)</td>
<td>25.60 (4.57)</td>
<td>28.09 (4.55)</td>
<td>28.20 (3.81)</td>
</tr>
<tr>
<td></td>
<td>Psychological Health</td>
<td>21.070 (2.94)</td>
<td>22.14 (2.88)</td>
<td>22.67 (3.41)</td>
<td>23.15 (3.05)</td>
</tr>
<tr>
<td></td>
<td>Social Relations</td>
<td>9.71 (1.98)</td>
<td>11.27 (1.88)</td>
<td>11.05 (2.04)</td>
<td>11.54 (1.76)</td>
</tr>
<tr>
<td></td>
<td>Environment</td>
<td>28.50 (2.68)</td>
<td>28.81 (3.34)</td>
<td>29.52 (3.87)</td>
<td>30.46 (3.60)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>83.57 (7.79)</strong></td>
<td><strong>88.18 (10.19)</strong></td>
<td><strong>91.57 (9.77)</strong></td>
<td><strong>88.74 (11.75)</strong></td>
</tr>
</tbody>
</table>
**RESULTS**

Significant Pearson correlations between performance on cognitive tests, QoL and GDS, with level of significance in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Physical Health</th>
<th>Psych. Health</th>
<th>Social Relations</th>
<th>Environment</th>
<th>Total</th>
<th>GDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE score</td>
<td>.122 (.018)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.134 (.017)</td>
</tr>
<tr>
<td>Story A, Immediate Recall</td>
<td>.156 (.003)*</td>
<td>.123 (.015)</td>
<td>.155 (.003)*</td>
<td>.160 (.002)*</td>
<td>-1.62 (.004)*</td>
<td></td>
</tr>
<tr>
<td>Story A, Delayed Recall</td>
<td>.112 (.030)</td>
<td></td>
<td></td>
<td>.109 (.038)</td>
<td>-1.19 (.034)</td>
<td></td>
</tr>
<tr>
<td>Story B, Immediate Recall</td>
<td>.144 (.005)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1.31 (.019)</td>
</tr>
<tr>
<td>Story B, Delayed Recall</td>
<td>.105 (.043)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Story A + B, Immed.Rec.</td>
<td>.167 (.001)*</td>
<td>.125 (.016)</td>
<td>.136 (.009)*</td>
<td>.143 (.006)*</td>
<td>-1.64 (.003)*</td>
<td></td>
</tr>
<tr>
<td>Story A + B, Del. Recall</td>
<td>.120 (.02)</td>
<td></td>
<td></td>
<td>.105 (.044)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BNT – uncued correct</td>
<td>216 (&lt;.001)*</td>
<td>.175 (.001)*</td>
<td></td>
<td>.117 (.023)</td>
<td>.224 (&lt;.001)*</td>
<td></td>
</tr>
<tr>
<td>SDMT – correct</td>
<td>.251 (&lt;.001)*</td>
<td>.189 (&lt;.001)*</td>
<td>149 (.005)*</td>
<td>.236 (&lt;.001)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trail A</td>
<td>-.162 (.003)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trail B</td>
<td>-.144 (.009)*</td>
<td>-.195 (&lt;.001)</td>
<td>-.135 (.015)</td>
<td>-.158 (.005)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPVT</td>
<td>.167 (.006)*</td>
<td></td>
<td></td>
<td>.139 (.022)</td>
<td>.169 (.006)*</td>
<td></td>
</tr>
</tbody>
</table>
## RESULTS

Significant Pearson correlations between performance on cognitive tests, QoL and GDS, with level of significance in parentheses. *Cont...*

<table>
<thead>
<tr>
<th></th>
<th>Physical Health</th>
<th>Psych. Health</th>
<th>Social Relations</th>
<th>Environment</th>
<th>Total</th>
<th>GDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVLT (1+2+3)</td>
<td>.144 (.005)*</td>
<td></td>
<td></td>
<td></td>
<td>.110 (.036)</td>
<td>-.175 (.002)*</td>
</tr>
<tr>
<td>HVLT – trial 4</td>
<td>.131 (.011)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.114 (.042)</td>
</tr>
<tr>
<td>Reading time</td>
<td>-.132 (.031)</td>
<td>-.136 (.026)</td>
<td></td>
<td></td>
<td>-.159 (.010)</td>
<td></td>
</tr>
<tr>
<td>Reading pseudowords time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Words from F</td>
<td>.155 (.003)*</td>
<td>.110 (.033)</td>
<td></td>
<td></td>
<td>.152 (.004)*</td>
<td>-.140 (.012)</td>
</tr>
<tr>
<td>Number of Animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.228 (&lt;.001)*</td>
<td>-.256 (&lt;.001)*</td>
<td>-.124 (.017)</td>
<td>-.221 (&lt;.001)*</td>
<td>-.294 (&lt;.001)</td>
<td>1.56 (.005)*</td>
</tr>
<tr>
<td>Years of education</td>
<td>.244 (&lt;.001)*</td>
<td>.146 (.005)*</td>
<td>.149 (.004)*</td>
<td>.172 (.001)*</td>
<td>.260 (&lt;.001)*</td>
<td></td>
</tr>
<tr>
<td>Physical Health</td>
<td>1</td>
<td>.431(&lt;.001)*</td>
<td>.279 (&lt;.001)*</td>
<td>.406 (&lt;.001)*</td>
<td>837 (&lt;.001)*</td>
<td>-.351 (&lt;.001)*</td>
</tr>
<tr>
<td>Psychological Health</td>
<td>1</td>
<td>.377 (&lt;.001)*</td>
<td>.346 (&lt;.001)*</td>
<td>.742 (&lt;.001)*</td>
<td>-588 (&lt;.001)*</td>
<td></td>
</tr>
<tr>
<td>Social Relations</td>
<td></td>
<td>1</td>
<td>349 (&lt;.001)*</td>
<td>549 (&lt;.001)*</td>
<td>-441 (&lt;.001)*</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>-.552 (&lt;.001)*</td>
</tr>
</tbody>
</table>

*Note.* Relationships marked with an asterisk indicate relationships that are significant at a level of .01.
RESULTS

• Cognitive performance and QOL
• Physical Health was related to the performance on cognitive tasks assessing overall cognitive performance (MMSE, r = .122, p = .018) and working, and long term memory
  ▪ Subjective reports of physical well-being were also related to oral naming abilities measured by the BNT; r = .216, p < .001; and receptive vocabulary (PPVT); r = .167, p = .006.
  ▪ Executive tasks incorporating verbal fluency (Words from F) and graphomotor abilities (SDMT) were also significantly related to Physical Health, r = .155, p = .003, and r = 251, p < .001 respectively
RESULTS - Cognitive performance and QOL

- Verbal Fluency and the SDMT were related to Psychological Health; \( r = .110, p = .033 \); and \( r = .189, p < .001 \) respectively.

- Psychological Health was also related to certain measures of working memory (Immediate Recall of Stories A and B, \( r = .125, p = .016 \)) and to confrontational naming (BNT), \( r = .175, p = .001 \).

- Ratings of social support were significantly related to SDMT; \( r = .149, p = .005 \); and story recall; \( r = .136, p = .009 \).

- Environmental support/satisfaction was not related to any of the cognitive-linguistic measures at an adjusted level of significance of .02 to account for multiple tests.
RESULTS - Cognitive performance and QOL

- Age was not related to any of the four domains of WHOQOL-BREF, nor their total combined score.

- Education was significantly related with all four domains and with the total score of QoL, \( r = .260, p < .001 \)
  - Physical Health, \( r = .244, p < .001 \)
  - Psychological Health, \( r = .146, p = .005 \)
  - Social Relations, \( r = .149, p = .004 \)
  - Environment, \( r = .172, p = .001 \)

- The four domains of WHOQOL-BREF were inter-related and significantly contributed to the total score of QoL

- GDS score was related to all cognitive measures and all WHOQOL-BREF domains and total score.

- GDS was not related to either Education or Age (\( p > .05 \)).
RESULTS - Cognitive performance and QOL

- Males reported higher levels of satisfaction than females across the 4 domains and with the total score of QoL, $t(364) = 5.858, p < .001$
  - Physical Health, $t(341.169) = 4.878, p < .001$
  - Psychological Health, $t(356.160) = 5.416, p < .001$
  - Social Relations, $t(367) = 2.389, p = .017$
  - Environment, $t(374) = 4.385, p < .001$

- Performance on the SDMT was systematically correlated with scores on the WHOQOL-BREF domains across gender.

- Gender, score on GDS and years of education made significant contributions to predicting the total score on WHOQOL-BREF; $p < .001$.

- The size and direction of the relationship suggests that higher scores on the WHOQOL-BREF were obtained by persons with lower GDS scores, higher years of education and male gender.
<table>
<thead>
<tr>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>WHOQOL- BREFtotal (DV)</td>
</tr>
<tr>
<td>GDS</td>
</tr>
<tr>
<td>Education</td>
</tr>
<tr>
<td>GDS and Education</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>WHOQOL- REFtotal (DV)</td>
</tr>
<tr>
<td>GDS</td>
</tr>
<tr>
<td>GDS and Education</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>WHOQOL-BREFtotal I (DV)</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>GDS</td>
</tr>
<tr>
<td>Education</td>
</tr>
<tr>
<td>Gender and GDS and Education</td>
</tr>
</tbody>
</table>

Note. Total Score of QoL satisfaction for the two genders separately, and Sequential Stepwise Regression for the two genders combined and gender being the first predictor. GDS = Geriatric Depression Scale.
Cognitive-linguistic domains such as working memory, naming abilities, receptive vocabulary, and executive functioning were related to the physical health and psychological health domains of the WHOQOL-BREF.

No significant relationship between cognitive-linguistic performance and environmental domain was observed.

The social support domain yielded limited associations with cognitive performance. These relationships were small, but significant in a large group of cognitively healthy adults.

Performance on GDS was predictive of their self-reported score of quality of life. Fewer symptoms of depression were related to increased satisfaction with life.

Males and those who attended school for more than 10 years reported higher levels of satisfaction in all four domains of the WHOQOL-BREF.
CONCLUSIONS

- Self-reports of QoL remain stable in older adulthood. Demographic variables such as gender and years of education affect several domains of QoL and, along with depression, account for a significant part of the WHOQOL-BREF variance.

- Cognitive-linguistic measures correlated with the physical and psychological health of the WHOQOL-BREF in healthy older adults.

- Lower levels of QOL are not associated with healthy cognitive aging and those demonstrating low levels of satisfaction with life should be followed up to determine underlying causes.

- Programs offering services to the elderly to help them maintain their QoL, should consider not only physical conditions, but also domains from where they can derive pleasure, such as psychosocial support and relationships.

- Interventions focusing on improving QoL should take into consideration the persons’ cognitive abilities

- Females, those with lower education levels and higher symptoms of depression are at higher risk for lower levels of QoL and future studies should explore potential interventions for persons at risk.
Thank you for your attention