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Sex differences in the association of physical function and cognitive function with life satisfaction in older age: The Rancho Bernardo Study

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ABSTRACT

Objectives: This study examines the cross-sectional associations of cognitive and physical function with life satisfaction in middle-class, community-dwelling adults aged 60 and older.
Study design: Participants were 632 women and 410 men who had cognitive function tests (CFT) and physical function tasks (PFT) assessed at a clinic visit between 1988 and 1992, and who responded in 1992 to a mailed survey that included life satisfaction measures. Cognitive impairment was defined as ≤24 on MMSE, ≥132 on Trails B, ≤12 on Category Fluency, ≤13 on Buschke long-term recall, and ≤7 on Heaton immediate recall. Physical impairment was defined as participants' self-reported difficulty (yes/no) in performing 10 physical functions. Multiple linear regression examined associations between life satisfaction and impairment on ≥1 CFT or difficulty with ≥1 PFT.
Main outcome measures: The Satisfaction with Life Scale (SWLS; range:0–26) and Life Satisfaction Index-Z (LSI-Z; range:5–35).
Results: Participants' average age was 73.4 years (range = 60–94). Categorically defined cognitive impairment was present in 40% of men and 47% of women. Additionally, 30% of men and 43% of women reported difficulty performing any PFT. Adjusting for age and impairment on ≥1 CFT, difficulty performing ≥1 PFT was associated with lower LSI-Z and SWLS scores in men ($\beta = -1.73$, -1.26, respectively, $p < 0.05$) and women ($\beta = -1.79$, -1.93, respectively, $p < 0.01$). However, impairment on ≥ 1 CFT was not associated with LSI-Z or SWLS score after adjusting for age and difficulty with ≥1 PFT.
Conclusions: Limited cognitive function was more common than limited physical function; however, limited physical function was more predictive of lower life satisfaction. Interventions to increase or maintain mobility among older adults may improve overall life satisfaction.

1. Introduction

The proportion of the U.S. population aged 65 years and older is currently 13% and is expected to increase to 20% by 2050 [1]. With this shifting U.S. demographic, a greater proportion of life years will be spent at older ages, and there has been growing interest in quality of life and successful aging. Knowledge of what defines aging "successfully" has evolved over the years.

According to Rowe and Kahn, successful aging involves three components: low levels of disease and disability; high cognitive and physical function; and active engagement with life [2]. More recent contributions emphasize the concept of life satisfaction [3], which has been suggested to be more important for successful aging than the presence or absence of illness or disability [4].

Previous studies have suggested that cognitive and physical functions are associated with life satisfaction [5–10]. For example, St. John et al. [6] reported lower life satisfaction among individuals with cognitive impairment and physical impairment among a Canadian population-based sample of 1620 adults aged 65–85 years. Berg et al. [7] found that cognitive and physical function were positively correlated with life satisfaction in a Swedish population-based sample of elderly men and women aged 80 and older, but stepwise regression analyses showed that these measures did not account for a significant amount of variance in life satisfaction scores. Jopp et al. [9] found subjective health and activities of daily living to be predictive for life satisfaction among this sample of community-dwelling New York City adults aged 95–107 years. While these studies demonstrate associations between life satisfaction and cognitive and physical function, all but one were

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internationally-based, and they were either limited to the oldest old, assessed life satisfaction with a single scale not validated among older populations, or found associations only in bivariate analysis.

The present cross-sectional study examines the associations of cognitive and physical function with life satisfaction in a cohort of middle-class, community-dwelling men and women aged 60 years and older in the United States.

2. Methods

2.1. Participants

Between 1972–74, 6629 individuals from Rancho Bernardo, a geographically defined Southern California community, were enrolled in a study of heart disease risk factors. These individuals were followed ever since with periodic research clinic visits and mailed surveys. Participants for the present study consist of men and women who attended a follow-up clinic visit in 1988–92 (n = 1727) when cognitive function and physical function were assessed, and who also completed a mailed survey assessing life satisfaction in 1992. Participants who were younger than age 60 years (n = 189), had a history of stroke (n = 124) or Parkinson's disease (n = 16), were missing all cognitive (n = 2) or physical function variables (n = 1), or did not return the mailed questionnaire (n = 332) were excluded. Additionally, those missing responses to three or more items on the Satisfaction with Life Scale (SWLS), or five or more items on the Life Satisfaction Index-Z (LSI-Z) (n = 21) were also excluded, leaving a final sample of 1042 participants (410 men and 632 women) for analysis. This study was approved by the University of California, San Diego Human Research Protections Program; all participants gave informed consent prior to participation.

2.2. Procedures

During the 1988–92 clinic visit, a self-administered survey was used to collect demographic and behavioral information including age, education (some college or more vs. no college), exercise three or more times per week (no/yes), alcohol consumption three or more times per week (no/yes), smoking history (never/past/current, amount smoked per day, years smoked). Individuals were also queried about their medical history, including physician-diagnosed cancer, diabetes, heart attack, arthritis and osteoporosis.

During an interview, physical function was assessed by asking whether participants had difficulty performing a variety of physical movements, including bending down to pick up lightweight items from the floor; lifting a ten-pound object up from the floor; reaching for an object above their head; getting into and out of an automobile; walking 2 or 3 blocks outside on level ground; climbing up 10 steps without stopping; and walking down 10 steps. Participants were also asked about functional tasks, including putting socks or stockings on either foot; doing heavy housework, such as scrubbing floors, washing windows, and yard work; and shopping for groceries or clothes.

Trained nurses measured height and weight with participants wearing light clothing and no shoes; body mass index (BMI), calculated as weight in kilograms (kg)/height in meters $(m)^2$, was used as an estimate of obesity. Information on medication use, including estrogen replacement in women, was obtained and validated with pill containers and prescriptions brought to the clinic for that purpose.

Cognitive function was assessed by trained interviewers during a battery of standardized tests. The Mini-Mental State Examination (MMSE) was used to assess orientation, registration, attention, calculation, language and recall [11]. Sub-tests of the MMSE included Serial 7s, which was calculated by having participants count backwards from 100 by increments of seven, and spelling the word "world" backwards, which assessed attention. Category Fluency was used to evaluate verbal memory by asking participants to name as many animals as possible in one minute [12]. The Trail-Making Test, Part B from the Halstead-Reitan Neuropsychological Test Battery (Trails B) tested visuomotor tracking and attention by having participants scan a page for 300 s to identify numbers and letters in specified sequences [13]. The Buschke-Fuld Selective Reminding Test was used to examine short- and long-term storage and retrieval of spoken words [14]. The Heaton Visual Reproduction Test was used to assess memory for geometric forms and included components of immediate recall, delayed recall and copying [15]. Concentration was evaluated using items from the Blessed Information Memory Concentration Test [16]. For Trails B and the Buschke-Fuld short-term memory test, higher scores indicate worse performance; for all other tests, higher scores indicate better performance. Previously defined cut-offs as provided by the UCSD Alzheimer's Disease Research Center (ADRC) were available to categorically defined poor performance for five tests; specifically, participants were classified as having poor cognitive performance if scored $\leq$24 on total MMSE, $\geq$132 on Trails B, $\leq$12 on the Category Fluency test, $\leq$13 on the Buschke long term recall, and $\leq$7 on Heaton immediate recall.

Life satisfaction was assessed by response to a mailed survey using the LSI-Z [17] and SWLS[18]. The LSI-Z consists of 13 statements for which participants responded either "agree," "disagree," or "don't know." A response of "agree" to eight of the statements and "disagree" to the remaining five indicate satisfaction. Participants received two points for each response indicating satisfaction, one point for a response of "don't know", and zero points for each response indicating dissatisfaction. Scores range from 0 to 26 with higher values indicative of greater life satisfaction. The SWLS consists of five statements for which participants indicate their level of agreement on a seven-point Likert scale with one being "strongly disagree" and seven being "strongly agree." Scores range from 5 to 35 with higher values indicating greater life satisfaction. Cronbach's alpha for both men and women was 0.81 for LSI-Z and 0.88 for SWLS.

2.3. Statistical analysis

Descriptive statistics were computed for all variables, including means and standard deviations (SD) for continuous measures, and percentages for categorical measures. Pack-years of smoking was calculated as (the number of cigarettes smoked per day/20) x (the number of years smoked). Comparisons between men and women were performed using *t*-tests for continuous variables and chi-square analysis for categorical variables; because of the significant differences found, all further analyses were stratified by sex. Differences in mean LSI-Z and SWLS scores by categories of covariates were examined using *t*-tests and ANOVA; covariates significantly associated with life satisfaction at $p < 0.15$ were included in multivariable models. Multiple linear regression modeling was used to examine the association of cognitive function and physical function with life satisfaction while adjusting for age, education, exercise, alcohol use and history of chronic disease. Separate models were run examining each of the 12 continuous cognitive function variables, the five dichotomized variables that classify individuals as cognitively impaired or not impaired, as well as the 12 individual physical movement and functional task variables. In addition, to determine if a relatively low level of impairment makes a difference in life satisfaction, and whether that difference varies by type of impairment, participants were categorized on whether they had impairment on one or more cognitive function tests (CFT) and