Cognitive Function and Depression in Elderly People

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Abstract

Recent studies confirmed the association between depression and cognitive decline in old age, but the nature of this association is still not very clear. The aims of this study were to investigate the possible association between depression and cognitive function in elderly institutionalized people and to determine moderating psychosocial factors in this association. Subjects were 561 residents of 11 older people's homes in Zagreb, Croatia, 160 (28.5%) men and 401 (71.5%) women, aged 56-96 years (average 79 years), ambulatory and not diagnosed with dementia. The Clifton Cognitive Function Scale and scales measuring depression, self-perceived health, social participation, and functional ability were administered. Subjects' education and objective health status were controlled for in our analysis. Data analyses confirmed that depression and cognitive function in old age are associated, but this association changes in the presence of different moderating variables, which can simultaneously affect both cognitive function and depression, but each to a different degree and direction.

Keywords: cognitive function, depression, old people

Introduction

Cognitive decline and symptoms of depression are among the most common problems in older persons, and may occur in relation to various risk factors, such as health conditions and psychosocial factors. From the biopsychosocial theoretical perspective, the etiology of depression in old age should be regarded through interactions with biological (e.g. disease, biological regulatory systems), psychological (e.g. cognitive functioning) and social (e.g. social engagement) factors (Blazer, 2003).

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Relatively high rates of depressive symptomatology (app. 15%) may be due to the high rates of physical disease co-morbidity and disability in older adults, but this mood state has also been shown prospectively to predict disability, morbidity and mortality, independent of baseline disease and functioning status (Gruenewald & Kemeny, 2007). Depression and depressed mood has been shown to predict coronary heart disease, cancer and all-cause mortality in samples with disease or those that were initially healthy at baseline evaluation.

Recent studies confirmed the association between depression and cognitive decline in old age, but the nature of this association is still not very clear (Andel, Hughes, & Crowe, 2005; Blazer, 2003; Sephton et al., 2003; Van Hooren et al., 2005; Yaffe et al., 1999). It may be that common biological processes underlie both, specifically age-associated changes in major biological regulatory systems – the immune and neuroendocrine, that may play a role in the development of cognitive impairment and depression with increasing age (Gruenewald & Kemeny, 2007). Early depressive symptoms among subjects with minimal cognitive impairment (MCI) may represent a preclinical sign and should be considered a risk factor for impending Alzheimer's disease or vascular dementia. In addition, incipient Alzheimer's disease may be a risk factor for depression (Blazer, 2003).

Even if we assume that similar biological processes regulate age changes in cognitive function and depressive mood state, however, these age-associated biological vulnerabilities would occur within the context of individuals' psychosocial, behavioural and physical environments (Gruenewald & Kemeny, 2007).

Similar two-way associations between depression and other indicators of psychological or physical health conditions have been confirmed in numerous studies. There is increase in research evidence that links subjective health assessments, and underlying psychological factors, to objective disease outcomes and mortality (Idler, 1993; Thomae, 1992). Regardless of their objective health status, older respondents with poorer self-perceived health experienced greater depression (Despot Lučanin, 2003), and mortality (Idler, 1993) throughout follow-up periods of 7-17 years. In addition, late life depression has been found to be a risk for poor self-perceived health over time (Blazer, 2003; Yaffe et al., 1999).

Social activity and social contacts have also been confirmed as risk factors for poorer self perceived health (Despot Lučanin, 2003), increased morbidity and even greater mortality (Rozzini, Bianchetti, Franzoni, Zanetti, & Trabucchi, 1991) in older people. Older people who participate in some kind of social activity and who visit or talk with friends or relatives may decrease their risk of mortality by almost one-half (Silberman et al., 1995).

Depression is clearly associated with functional impairment and effects disability status over time. Disability is also a risk factor for depression (Blazer, 2003). Depression, chronic illness and functional disability have been confirmed to be associated with greater mortality risk in older people.

Some studies on specific older populations, however, have found different results. Nursing home-based studies on risk indicators of depression are scarce, and the findings are conflicting. For instance, with regard to cognitive impairment and functional limitations, not only positive and negative, but also a lack of associations with depression have been reported (Jongenelis et al., 2004). A limitation of these studies is that they highlighted either physical or psychological functioning, but not both. In addition, subject samples' characteristics vary a lot in different studies, which might result in different findings and conclusions (Boon et al., 1995). Contradictory findings can also be noticed regarding subjects' age and gender (Jongenelis et al., 2004), so basic sociodemographic characteristics of older people under examination should be specifically considered when assessing their functioning.

Knowledge of factors that are associated with optimal functioning may help to improve autonomy and well-being in old age. Much can be learned from individuals who function on a high level according to psychological and physical criteria. A high level of general functioning is suggested to be positively associated with high cognitive functioning. Likewise, poor physical function, as indexed by self-rated health, was found to be related to poor performance on neuropsychological tests in a healthy older population (Van Hooren et al., 2005). Few studies, however, have examined in depth the relationship between general high functioning and cognitive performance in old age.

In Croatia, research on some specific problems of aging, especially in the domain of psychological health, is scarce. Recently, several interdisciplinary studies have begun on cognitive function and impairment in old age, specifically in regards to neurological problems and cardiovascular risk factors (Bašić et al., 2004; Despot Lučanin, Lučanin, & Petrušić, in press).

The aims of this study were, first, to investigate the possible association between depression and cognitive function in old institutionalized people. Second, to identify if the observed variables: age, functional ability, self perceived health, social participation, depression, and cognitive function share underlying common factors, which could better explain associations among them. Third, to determine the effects of moderating psychosocial factors in this association such as specifically, sociodemografic, functional ability, self perceived health, and social participation variables. We assume that the strength of the depression-cognitive function correlation may not be the same for differing levels of the moderating variables.

Method

Subjects

Subjects were 561 residents of 11 older people's homes in Zagreb, Croatia, 160 (28.5%) men and 401 (71.5%) women, aged 56-96 years (average 79 years). All subjects were ambulatory and not diagnosed with dementia.

Instruments

Data were collected using several measurement instruments.

Cognitive Function Scale of the CAPE test (*Clifton Assessment Procedures for the Elderly*, by Pattie & Gilleard, 1996) consists of 12 information/orientation items, each scored 1 point, and 4 mental ability tasks: counting, saying alphabet, word list reading, each scored 0-3 points, and name signing, scored 0-2 points. Total score range is 0-23. Score less than 15 indicates mild cognitive decline, and less than 8 suggests considerable cognitive decline. Test-retest reliability coefficient of this test was .74 - .89 (Pattie & Gilleard, 1996).

Depression Scale for the Elderly, created after *Zung's Depression Scale* (Bowling, 1991; Despot Lučanin, 2003) was administered, consisting of 20 items measuring the frequency of occurrence of feelings and symptoms, lately, on four-point scales (from 1 = almost never to 4 = almost always). Scores for the positive items are reversed before summing. Higher score (range 20-80) indicates more symptoms of depression. The internal consistency coefficient, Cronbach's alpha, of this scale for older persons in research in Croatia was .88 (Despot Lučanin, 2003).

Functional ability was assessed by *Activities of Daily Living Index* (ADL), by Shanas et al., 1968 (Bowling, 1991; Despot Lučanin, 2003), consisting of 14 items measuring the degree of independence in performing daily activities: personal care, walking inside and outside of home, basic domestic chores, on four-point scales (from 1 = totally dependent on other people's help to 4 = totally independent). Higher score (range 14-56) indicates better functioning. The internal consistency coefficient, Cronbach's alpha, of this scale for older persons in research in Croatia was .96 (Despot Lučanin, Lučanin, & Havelka, 1997).

Self-perceived health was assessed by 2 linearly added four-point scales: subjects rated their general health (*"How would you rate your health"*), and compared their health to that of their age-peers (*"In comparison with your age peers, how would you rate your health"*), from 1 = poor, to 4 = excellent. Higher score (range 2-8) indicates better self-perception.

Social participation was assessed by the 5-item scale, measuring the frequency of participation in different social activities (social, cultural, religious, etc.), on three-point scales (1 = never, 2 = sometimes, 3 = often). Higher scores (range 5-15) indicate more social participation. The internal consistency coefficient, Cronbach's

alpha, of this scale for older persons in research in Croatia was .61 (Despot Lučanin, 2003).

A sociodemographic characteristics questionnaire was administered, including items assessing age, gender, education, marital status, and health status variables.

Procedures

All subjects signed an informed consent form to participate in the research. The data were collected individually, in the institution. The measurement instruments were administered by trained interviewers in the form of a structured interview.

Results

Descriptive statistics and correlation coefficients between observed variables were calculated. Factor analysis was performed in order to identify common factors in the observed set of variables.

Descriptive Statistics

Descriptive statistics and correlation coefficients for the variables used in the analyses are presented in Table 1 and Table 2.

Table 1. Scale means and descriptives for the observed variables

	Cognitive function	Depression	Functional ability	Self perceived	Social participation	Age
M	18.84[x]	2.09	3.31	2.79	1.58	78.81[x]
SD	2.43	0.45	0.58	0.71	0.48	7.01
Scale Range	0-23[x]	1-4	1-4	1-4	1-3	56-96[x]
Skewness	-1.09	0.28	-1.18	-0.48	0.64	-0.37
Kurtosis	2.69	-0.55	1.43	-0.36	-0.35	0.24

[x]means and range representing total score distribution

Mean values and distributions descriptives (Table 1) show that subjects, despite their age (80% between 70 and 87 years, with 10% younger and 10% older than this age), have quite good cognitive function and functional ability. Cognitive function in subjects is well preserved – only 7% or 15 persons scored less than 15, indicating mild cognitive decline. This result is good, but expected, since one of the inclusion criteria was for the subjects not to be diagnosed with dementia. Almost 80% of subjects manage their daily activities with no or just some difficulties, but independently. It is good, but also expected, since the second inclusion criterion was for the subjects to be ambulatory. Probably due to these inclusion criteria,

cognitive function and functional ability distributions are slightly negatively skewed (-1.09 and -1.18, respectively), which somewhat limits the interpretation of results and the strength of conclusions.

Table 2. Pearson correlation coefficients for obseved variables

Variables	1	2	3	4	5
1. Cognitive function	-				
2. Depression	-.19**	-			
3. Functional ability	.19**	-.40**	-		
4. Self perceived health	.10*	-.43**	.46**	-	
5. Social participation	.20**	-.22**	.16**	.17**	-
6. Age	-.12**	.05	-.01	.16**	.02

$*p < .05; **p < .01$

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The scale mean value and distribution descriptives of depression scale results (Table 1) do not indicate serious levels of depression symptoms in the sample. The majority of the subjects were not depressed (44%) or showed only mild symptoms of depression (28%). However, 21% showed moderate depression, and 8% showed results that indicated a serious depressed condition. These percentages are in accordance with other studies that confirm similar prevalence of depressed old persons, especially in institutions (Blazer, 2003; Yaffe et al., 1999).

Older people in this research on average perceive their own health as fair to good (Table 1). More than two thirds of the subjects (76%) perceived their health as relatively good, while 24% were in the lowest result quartile and perceive their health as poor. Self-perceived health was moderately strongly correlated with functional ability and depression ($r = .46$ and $r = -.43$, respectively, Table 2). In this research, old people with better functional ability and less depression symptoms perceive their health better.

On average, the subjects sometimes participate in different social activities (Table 1), in or out of the home for older people. Moreover, although the majority do engage in some social activity, there are, however, about 30% in the lowest

result quartile. Social participation is weakly correlated with both depression and cognitive function ($r = -.22$ and $r = .20$, respectively), so it can be interpreted that old persons with more depression symptoms and poorer cognitive function would be less socially active, and vice versa.

Regarding education, 47% of subjects went to school for up to 8 years, 39% for 9-12 years and 14% for 13 or more years.

Pearson correlation coefficient results indicate the association between cognitive function and depression was not high ($r = -.19$) but was statistically significant. All other correlation coefficients, between all observed variables, range from low to medium, but are significant, except for age, which is significantly correlated only with self perceived health and cognitive function. Subjective health variables – self-perceived health and functional ability were more strongly correlated with depression than with cognitive function (Table 2).

Common Factors Structure

A principal component factor analysis was performed in order to identify if observed variables share underlying common factors, which could better explain associations among them. Six variables: age, social participation, self-perceived health, functional ability, depression and cognitive function can be interpreted by two extracted factors. The first two extracted components with their initial eigen values higher than 1, in accordance with Guttman-Kaiser criteria (2.07, 1.15, 0.94, 0.77, 0.59 and 0.49), explained 53.7% of total variance (Table 3).

Table 3. Principal component analysis – Component matrix

Variables	Component	
	1	2
Age	.03	**.80**
Social participation	**.46**	-.19
Self perceived health	**.74**	.37
Functional ability	**.75**	.07
Depression	**-.75**	.03
Cognitive function	.42	**-.57**
Eigen values	2.07	1.15
% of variance	34.49%	19.18%
Total variance explained	53.67%	

Factor 1 was predominantly determined by positive loadings for self-perceived health, functional ability and a negative loading for depression (factor loadings .74, 0.75 and -.75, respectively), but it was also determined, to a lesser degree, by positive loadings for social participation and cognitive function (factor loadings .46 and .42). We named it "the Good condition factor" because it is defined by subjective feelings of psychophysical health and mood, regardless of age (Table 3).

This factor explained 34.5% of the variance. Factor 2 was predominantly determined by age and cognitive function, negatively positioned (factor loadings .80 and -.57), and, to a lesser degree, by self-perceived health (factor loading .37). We called it "the Bad condition factor" because age and cognitive function variables are in the opposite position in the factor space (Table 3). This factor explained an additional 19.2% of the variance.

Moderating Variables Analysis

Since characteristics of the subjects' sample seem to be of different relevance in different studies, and subjects in this research are a heterogeneous group, we assumed that relationships of observed variables with the depression-cognitive function correlation are not the same for different levels of the moderating variables. Moderating psychosocial variables, identified as significantly correlated with either cognitive function or depression, are listed and described in Table 2. For each level of different moderating variables, a separate Pearson correlation coefficient between cognitive function and depression was calculated (Table 4). The cut-off value for defining variable levels was the mean of the distribution. For a better understanding of this interpretation, note that cognitive function and depression are negatively correlated (Table 1).

Table 4. Pearson correlation coefficients between cognitive function and depression for different moderating variables' levels

Moderating variables	Variable levels	r	N
Gender	Male	-.23**	145
	Female	-.19**	366
Age	81 - 96	-.21**	206
	71 - 80	-.20**	247
	56 - 70	-.16	58
Education (years)	0 - 8	-.23**	232
	9 - 12	-.18**	203
	13 +	.07	75
Functional ability	Good	-.25**	163
	Fair	-.02	227
Social participation	High	-.19**	231
	Low	-.14*	247
Self-perceived health	Good	-.25**	258
	Poor	-.14*	247

$*p < .05; **p < .01$

Results indicate that basic sociodemographic variables, when observed at different levels, like: male gender, older age, and lower education, increase the correlation between cognitive function and depression, as opposed to female gender, younger age, and higher education. However, the variable levels of: fair functional ability, lower social participation, and poor self-perceived health, decrease this correlation as opposed to good functional ability, higher social

participation, and good self-perceived health effects (Table 4). Stronger correlation indicates that moderating variables similarly affect both cognitive function and depression variables, presumably meaning that, according to variable levels, being in subgroup of male, older and less educated subjects increases depression and decreases cognitive function, and vice versa. Weaker correlations indicate that the strength of association of moderating variables with depression and cognitive function is different in subgroups of subjects, according to variable levels. Presumably, lower levels of functional ability, social participation, and self-perceived health are more strongly associated with depression than with cognitive function, meaning that depression increases with these conditions more than cognitive function decreases. For higher levels of these moderating variables, the interpretation is the opposite.

Discussion

Physical, Psychological and Social Functioning of Participants

Overall average functioning – cognitive and physical, of older persons in this research is quite good (Table 1). Considerable cognitive impairment in old age results in a diminished sense of well-being and impaired daily functioning (Despot Lučanin, 2003). In this research, only 7% of subjects showed mild cognitive decline. The majority of subjects (almost 80%) managed their daily activities with no or just some difficulties, but independently. Functional ability indicates the degree of self-care, regardless of objective health status. Disease need not cause disability or dependence. The true measure of health status is comprised of any disease presence and the degree of functional disability. Older persons think of themselves as ill only when illness disrupts or interferes with their daily activities (Ikegami, 1995).

Self-perceived health in older persons in this research, on average, is fair to good. A majority of the subjects (76%) perceive their health as relatively good. Considering the fact that 87% subjects have some chronic disease, their self-perception of health does not realistically reflect their objective health status, which is the usual finding in older people. Older persons usually expect chronic illness because of their age; however, unless the illness causes severe disability, they do not consider it important for the quality of their lives. This is reflected in their self-assessment of health. The medium strong correlation of self-perceived health with functional ability ($r = .46$) and depression ($r = -.43$) suggests the importance of psychological factors that play important role in the way older people perceive their health (Smith, Young, & Lee, 2004). Those who function better and experience less depression symptoms also perceive their health better.

Although on average subjects in this study reported rarely experiencing depression symptoms, and majority of subjects showed none (44%) or only mild symptoms of depression (28%), there is some proportion of those with moderate (21%) depression, and 8% show results that indicate a serious depressed condition. Similar findings are typically found in old persons, especially those living in institutions (Blazer, 2003; Yaffe et al., 1999). Although these results do not indicate clinical depression, but symptoms of depression, they suggest the need to pay more attention to these persons and their psychological status.

On average, the subjects in this research sometimes participate in social activities. Still, there are about 30%, who do not. Weak but significant correlations with both depression and cognitive function suggest that old persons with more depressive symptoms and poorer cognitive function would be less socially active, and vice versa. Other studies have shown an association of certain social network variables (i.e., "social activities", "visits or talks with friends or relatives") with institutionalization and/or mortality of older people (Rozzini et al., 1991; Silberman et al., 1995).

Relationships among Cognitive Function, Depression and Moderating Variables

The association between cognitive function and depression is indicated by the significant, although weak correlation (r = -.19, Table 2). Similar findings were found in other research on cognitive function - depression relationship in older persons (Andel, Hughes, & Crowe, 2005; Blazer, 2003). Even in a group of older persons who display good cognitive function and prevalently no or only mild symptoms of depression, this association remains, along with other associations between observed variables. With the aim to explain these complex associations, two different analyses were performed.

Two underlying common factors were extracted by the factor analysis, which could better explain associations among the variables observed in this research (Table 3). The "Good condition factor" (explaining 34.5% of the variance) is predominantly defined by subjective feelings of psychophysical health and mood (self perceived health, functional ability and depression). The "Bad condition factor" (explaining 19.2% of the variance) is predominantly defined by age and cognitive function. The observed variables are quite distinctly placed at the two factors, although some weak loading of cognitive function at the first factor can be noticed.

Results of the second moderating variables analysis indicates that the strength of association of moderating variables with depression and cognitive function is different in subgroups of subjects, according to variable levels (Table 4). The basic sociodemographic variables here: gender, age, and education, when observed at different levels, increase the existing negative correlation between cognitive function and depression. This analysis indicates that male, older and less educated

subjects are at more risk for decreased cognitive function and increased depression (and vice versa). However, the levels of psychophysical and psychosocial variables like: functional ability, self-perceived health, and social participation, decrease this correlation, meaning that depression increases in old persons with lower levels of these conditions more than cognitive function decreases (and vice versa). This relationship is also confirmed by the factor analysis results. The Good condition factor has strongest loadings on the same three moderating variables and depression (in negative direction), while loading on cognitive function is weak. The Bad condition factor has strongest loadings on age and then cognitive function (in a negative direction).

Two different analyses suggested a similar interpretation of the results. Depression and cognitive function in old age are associated, but this association changes in the presence of different moderating variables' levels. The set of observed moderating variables in this study included psychophysical and psychosocial ones. The results of all analyses interpret considerable portion of total variance (53.7%), but enough space is left for other sets of variables to be considered in this relationship. Biological variables, in particular, could be assumed to have some effect, too. Biological mechanisms underlying this association are still not clear (Yaffe et al., 1999). It is possible that an underlying central nervous system alteration may cause both depressive symptoms and cognitive decline. On the other hand, high levels of cortisol may be associated with depression and may lead to neuronal death and cognitive decline. It is also possible that depressive symptoms and cognitive decline are both due to an underlying genetic predisposition or immune reactivity. Further exploration is needed.

Limitations of the Research

The limitations of this research need to be acknowledged. The sample is not representative of the older population. Data on older community-dwelling people should be added and compared for more general interpretation and conclusions. In addition, results of the presented research are cross-sectional. A follow-up study should add some valuable information on the relationship between depression and cognitive function in the ageing process. This is why high functioning (cognitive and physical) inclusion criteria for the participants were set, so that they could be followed-up and age changes studied.

Further Research Goals

Yaffe et al. (1999) asked whether depressive symptoms were a risk factor for cognitive decline by prospectively studying a group of community-dwelling women without dementia (N = 5781, age 65 and older). At baseline, women with more depressive symptoms had lower cognitive test scores than women with few symptoms. Cognitive scores declined during follow-up in all women. Women with more baseline depressive symptoms also had worse follow-up cognitive scores. A longitudinal study finding by Van Horen et al. (2005) was that physical functioning and mood predicted cognitive functioning in a large population sample (N = 669) aged 60 to 81 years over a 6-year period. A comparison of the relative contribution of these components revealed that poor psychological functioning (i.e., depressive and anxiety symptomatology), rather than poor physical health, may have the strongest implications for long-term cognitive functioning in older men and women.

A group that is of special interest for intervention would consist of older persons who have depressive symptoms, without meeting the DSM-IV criteria for depression, in order to evaluate their need for special care and treatment (Jongenelis et al., 2004).

Our subjects were prevalently women, rather old, modestly educated, but in good functional condition physically and cognitively, not many depressed, living in controlled environment where they are well cared for regarding their health and living conditions. They get a balanced diet, regular health care, and are stimulated to regular physical and social activities that are individually adjusted. Interrelations among these characteristics are reflected in our "Good condition factor" which dominates in explaining the variance of obtained results. It certainly suggests which conditions – psychological and physical, should be monitored in similar groups of older people.

Conclusion

The association between cognitive function and depression in the observed group of older people has been confirmed. The strength of association between them varies depending on other psychosocial variables and their levels. Taking into account the moderating variables in research is recommended because they can simultaneously have effects on both cognitive function and depression, but to a different degree and direction. Better insight into the nature of these associations could reveal risk factors for minimal cognitive impairment, clinical depression, and even for Alzheimer's disease or some other disease.

The question remains, raised by other studies as well, which other factors contribute to confirmed association between cognitive function and depression. Further research is needed.

The implications of these findings are interesting in terms of better identification of groups particularly susceptible to cognitive decline, and in terms of intervention in the form of specific and widely applicable strategies to maintain cognitive functions in old age.

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Kognitivne funkcije i depresivnost u starosti

Sažetak

Novija su istraživanja potvrdila povezanost između depresivnosti i kognitivnoga opadanja u starosti, međutim, priroda te povezanosti nije jasna. Ciljevi su ovoga istraživanja bili ispitati postoji li povezanost između depresivnosti i kognitivnih funkcija u starijih osoba koje žive u ustanovi te utvrditi kakva je uloga posredujućih psihosocijalnih čimbenika u toj povezanosti. U istraživanju je sudjelovao 561 korisnik iz 11 domova za starije i nemoćne osobe u Zagrebu, od toga 160 (28.5%) muškaraca i 401 (71.5%) žena, u dobi 56-96 godina (prosječno 79 godina), pokretni i ne-dementni. Primijenjene su ljestvice: kognitivnih funkcija (CAPE-test), depresivnosti, funkcionalne sposobnosti, samoprocjene zdravlja i socijalne participacije. Vodilo se računa o obrazovanju i zdravlju sudionika. Podatke su osobno, od svakoga sudionika, u ustanovi prikupili osposobljeni ispitivači. Rezultati su potvrdili malu povezanost između depresivnosti i kognitivnih funkcija u starijih osoba, ali ona se mijenja u prisutnosti promatranih posredujućih varijabli, povezanih i s depresivnošću i s kognitivnim funkcijama, ali u različitom stupnju i smjeru.

Ključne riječi: kognitivne funkcije, depresivnost, starije osobe