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Late-Life Depression as a Neuropsychiatric Symptom in the Oldest Old: Predictors from a German Nationwide Study

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Introduction

Late-life depression (LLD) is one of the most prevalent neuropsychiatric symptoms (NPS) in older adults and is associated with reduced quality of life, functional decline and an increased risk of cognitive impairment and dementia. Although biological, functional, psychological, and social determinants of LLD have been described, their relative contribution across the cognitive continuum from cognitively unimpaired (CU) to mild cognitive impairment (MCI) and dementia remains poorly understood.

Methods

Study Design

Data were obtained from the **German D80+ Study („Old Age in Germany“)**, the first nationwide representative study of adults aged **80 years and older** living in both private households and long-term care facilities in Germany. The interdisciplinary study was developed by researchers from **gerontology, sociology, psychology, and medicine** to comprehensively assess quality of life and ageing in the oldest-old. Data collection included written and telephone interviews and captured a broad spectrum of demographic, medical, gerontological, psychological, social, lifestyle, and cognitive characteristics. (5)

For the present analyses, participants with complete data on depressive symptoms, cognitive status, and all predictor variables were included. Cognitive status was classified as cognitively unimpaired (CU), mild cognitive impairment (MCI) or dementia using the DemTect. Depressive symptoms were assessed using the **Depression in Old Age Scale (DIA-S)**.

Predictor Domains

Based on previous theoretical and empirical evidence, individual variables were assigned *a priori* to six hypothesis-driven predictor domains representing complementary dimensions of late-life depression, including psychological, biological-physical, functional, lifestyle, social, and values-related factors (Table 2).

Statistics

Binary logistic regression analyses were performed separately for the total cohort and for participants with CU, MCI and dementia. Each predictor domain was analysed individually and subsequently combined into one comprehensive regression model. Model performance was evaluated using likelihood-ratio χ^2 statistics, Nagelkerke's R^2, and corresponding *p*-values.

Predictor group	No. of variables	Construct / content
Psychological Variables	13	Autonomy, life satisfaction, loneliness, positive affect, meaning in life, generativity and aging-related experiences.
Function	5	Functional health, ADL/IADL, assistive device use, health literacy and care grade.
Biological / Physical	9	Multimorbidity, somatic symptoms, medication, general health, pain, falls and weight loss.
Lifestyle	8	Lifestyle importance and practice, technology/internet use, club membership and political participation.
Social Support	2	Provided and received social support.
Values	14	Individual values, spirituality and attitudes toward death and dying.

Table 1: List of variables and their division into predictor groups

Variable	Total (n = 2337)	CU (n = 1563)	MCI (n = 534)	Dementia (n = 240)	*p* value
Age in years, M (SD)	85.4 (3.9)	84.7 (3.6)	86.3 (4.2)	87.2 (4.4)	< .001
Number of children, M (SD)	2.3 (1.1)	2.2 (1.0)	2.3 (1.1)	2.4 (1.2)	.036
BMI, kg/m², M (SD)	25.8 (4.2)	25.7 (4.0)	25.9 (4.3)	26.2 (5.1)	.290
Female gender, n (%)	1107 (47.4)	849 (54.3)	191 (35.8)	67 (27.9)	< .001
Completed primary education (9syears), n (%)	943 (42.1)	546 (36.4)	257 (50.0)	140 (61.1)	< .001
Three-year apprenticeship, n (%)	775 (36.3)	500 (34.9)	189 (38.7)	86 (40.6)	.002
Education in years, M (SD)	13.3 (1.7)	13.4 (1.7)	13.3 (1.6)	13.2 (1.7)	.406
Nursing home resident, n (%)	52 (2.7)	13 (1.0)	26 (6.0)	13 (6.9)	< .001
Married, n (%)	1138 (49.2)	773 (49.9)	260 (49.2)	105 (44.9)	.096

Table 2: Demographic characteristics of the total sample and according to cognitive status

Predictor group	Statistic	Total	CU	MCI	Dementia
Psychological variables	**n**	**1967**	**1347**	**436**	**184**
	Nagelkerke's R^2	0.397	0.391	0.495	0.336
	χ^2	636.18	423.26	188.63	50.26
	df	13	13	13	13
	p	< .001	< .001	< .001	< .001
Function variables	**n**	**2108**	**1442**	**465**	**201**
	Nagelkerke's R^2	0.084	0.076	0.125	0.046
	χ^2	127.50	78.05	43.14	6.80
	df	5	5	5	5
	p	< .001	< .001	< .001	.236
Biological-physical variables	**n**	**2066**	**1378**	**474**	**214**
	Nagelkerke's R^2	0.219	0.207	0.300	0.217
	χ^2	346.38	215.20	113.53	36.21
	df	9	9	9	9
	p	< .001	< .001	< .001	< .001
Lifestyle variables	**n**	**968**	**734**	**176**	**58**
	Nagelkerke's R^2	0.060	0.061	0.168	0.428
	χ^2	38.95	29.76	20.57	20.70
	df	15	15	15	13
	p	< .001	.013	.151	.079
Social support variables	**n**	**2283**	**1533**	**516**	**234**
	Nagelkerke's R^2	0.029	0.017	0.058	0.065
	χ^2	46.88	18.80	21.78	11.20
	df	2	2	2	2
	p	< .001	< .001	< .001	.004
Values variables	**n**	**2153**	**1457**	**492**	**204**
	Nagelkerke's R^2	0.088	0.086	0.172	0.215
	χ^2	135.77	89.41	63.69	34.22
	df	22	22	22	22
	p	< .001	< .001	< .001	.047
All variables combined	**n**	**690**	**542**	**118**	**30**
	Nagelkerke's R^2	0.564	0.595	1.000	NA
	χ^2	312.81	261.80	121.87	NA
	df	66	66	65	NA
	p	< .001	< .001	< .001	NA

Table 3: Binary logistic regression models by predictor group and cognitive status

Results

- Baseline demographic and clinical characteristics are presented in **Table 2**, while the allocation of variables to the six predictor groups is shown in **Table 1**.
- Binary logistic regression analyses revealed significant associations between all predictor domains and depressive symptoms in the total cohort, although their explanatory power differed substantially (**Table 3**). Among the individual domains, **psychological variables** demonstrated the highest explanatory value across the total sample (Nagelkerke's R^2 = 0.397), followed by **biological-physical variables** (R^2 = 0.219). Functional, values, lifestyle, and social support domains showed smaller but significant contributions to model fit.
- Across cognitive subgroups, **psychological variables consistently explained the largest proportion of variance**, particularly in participants with **MCI** (R^2 = 0.495) and **CU** (R^2 = 0.391). Biological-physical variables also showed strong predictive performance across all cognitive groups, whereas lifestyle, values, and social support exhibited more modest and cognition-dependent effects. The combined regression model demonstrated the highest overall explanatory value in the total cohort (R^2 = 0.564) and in participants with CU (R^2 = 0.595).

Conclusion

Psychological variables were the strongest predictors of depressive symptoms across cognitive groups, highlighting the importance of psychosocial well-being in adults aged 80 years and older. Biological-physical health also contributed substantially to depression risk, whereas functional, lifestyle, values, and social support factors showed smaller but significant effects.

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