

Profiles of Met and Unmet Care Needs in the Oldest Old Primary Care Patients with Cognitive Disorders and Dementia: Results of the AgeCoDe and AgeQualiDe Study

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Keywords

Camberwell Assessment of Needs for the Elderly · Dementia · Latent class analysis · Need profiles · Oldest old population

Abstract

Introduction: The prevalence of mild cognitive impairment (MCI) and dementia is increasing as the oldest old population grows, requiring a nuanced understanding of their care needs. Few studies have examined need profiles of

oldest old patients with MCI or dementia. Therefore, this study aimed to identify patients' need profiles. **Methods:** The data analysis included cross-sectional baseline data from $N = 716$ primary care patients without cognitive impairment ($n = 575$), with MCI ($n = 97$), and with dementia ($n = 44$) aged 85+ years from the multicenter cohort AgeQualiDe study "needs, health service use, costs and health-related quality of life in a large sample of oldest old primary care patients [85+]". Patients' needs were assessed using the Camberwell

Riedel-Heller and Janine Stein shared last authorship.

Assessment of Needs for the Elderly (CANE), and latent class analysis identified need profiles. Multinomial logistic regression analyzed the association of MCI and dementia with need profiles, adjusting for sociodemographic factors, social network (Lubben Social Network Scale [LSNS-6]), and frailty (Canadian Study of Health and Aging-Clinical Frailty Scale [CSHA-CFS]). **Results:** Results indicated three profiles: “no needs,” “met physical and environmental needs,” and “unmet physical and environmental needs.” MCI was associated with the met and unmet physical and environmental needs profiles; dementia was associated with the unmet physical and environmental needs profile. Patients without MCI or dementia had larger social networks (LSNS-6). Frailty was associated with dementia. **Conclusions:** Integrated care should address the needs of the oldest old and support social networks for people with MCI or dementia. Assessing frailty can help clinicians to identify the most vulnerable patients and develop beneficial interventions for cognitive disorders.

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Published by S. Karger AG, Basel

Introduction

Mild cognitive impairment (MCI) and dementia often lead to a number of life-changing impairments for those affected, including reduced functioning in psychological, social, and physiological areas of life [1]. The associated care needs of the growing oldest old population pose major challenges for the healthcare system. MCI is often regarded as a transitional stage between healthy aging and dementia, with an annual progression rate of 8–13% from MCI to dementia [2, 3]. In Germany, around 771,000 of the oldest old aged 85+ suffer from dementia, constituting 39.5% of all cases [4]. However, German general practitioners (GPs) tend to underdiagnose dementia in the oldest old [5]. According to Bohlken et al. [5], this may be attributed to the tendency of GPs to diagnose dementia only if relevant for healthcare, such as for the prescription of anti-dementia drugs. Given the predicted rise in dementia rates, individually tailored and needs-based care is becoming increasingly important [6]. Nevertheless, according to the unmet needs model [7], older people with cognitive impairment may have more difficulties in communicating their needs and a reduced ability to use their environment appropriately which makes it difficult for caregivers and healthcare professionals to provide adequate care. Affected patients may be more likely to exhibit problematic behaviors, such as agitation or repeated vocalizations as a

means of communicating needs [8]. Healthcare needs, as derived from the “capacity-to-benefit concept,” may be identified if there is potential for an effective treatment or health gain for an individual who is able to benefit from healthcare provision [9]. Healthcare needs are to be distinguished from subjective wishes or requirements. By definition, an unmet need refers to a specific problem of an individual that is not being adequately addressed through an appropriate intervention [9, 10]. This may be indicative of an over-supply, undersupply, or missing provision of healthcare services. Given the far-reaching consequences of unmet needs, such as poorer disease progression, premature institutionalization, and mortality, it is crucial to identify the complex needs of patients with cognitive impairment and dementia at an early stage using a valid assessment tool [11–13].

The Camberwell Assessment of Needs for the Elderly (CANE) [10] is a standardized instrument for recording the needs of older people. The CANE provides a comprehensive insight into the patient’s needs situation surveying the physiological, environmental, psychological, and social areas of life, with responses categorized as no, met, or unmet needs. Previous research, including meta-analytic studies, has reported that needs of dementia patients relating to memory, looking after home, mobility, daytime activities, company (i.e., social contacts), food, and money are often unmet [14–16]. Most studies focused on the frequencies of unmet needs associated with cognitive disorders, but little is known about the interrelatedness of these needs. To date, only a few studies using the CANE have examined need profiles of patients suffering from cognitive impairment or dementia [15, 17]. In the studies of Janssen et al. [15] and Sung and Chan [17], four need profiles were identified using latent class analysis (LCA). This statistical approach was used to classify response patterns of patients into distinct latent classes of needs, commonly referred to as need profiles. Especially in the context of personalized and integrated care for the oldest old, LCA is a promising person-centered approach as it takes into account the heterogeneity and different patterns of individuals’ needs. On this basis, integrated care approaches can be developed to address the needs that often co-occur in individuals, resulting in more effective customization of current interventions or the creation of new ones that target a wider range of needs. Recently, Janssen et al. [15] identified need profiles labeled “no needs,” “met psychological needs,” “met social needs,” and “unmet social needs” based on a European sample of community-dwelling dyads of people with mild to

moderate dementia, mean age 77.8 years, and their caregivers. Sung and Chan [17] found need profiles labeled “no need,” “met social and memory needs,” “no social and met memory needs,” and “unmet social and memory needs” based on a Singaporean sample of caregivers of older people aged 60 years and older with MCI. However, in both studies, the needs of patients with an average age of less than 85 years were assessed from the caregiver’s perspective using the CANE. There are currently no data available on the specific combinations of no, met, and unmet needs from the perspective of the oldest old aged 85+ with MCI or dementia. Taking into account the subjective experience of those affected (if the degree of cognitive impairment allows it) provides an important foundation for tailored and person-centered care [18]. The need profiles from the perspective of patients with MCI or dementia can inform about specific combinations of needs with MCI and/or dementia and optimize needs-based healthcare and treatment. Against this background, this exploratory study aimed to (1) identify need profiles in oldest old primary care patients with cognitive impairment and dementia aged 85 years and older, (2) describe the resulting need profiles based on sociodemographic, psychosocial, and clinical characteristics, and (3) investigate the need profiles in association with MCI and/or dementia.

Methods

Sample

The sample was based on cross-sectional baseline data from the German AgeQualiDe multicenter study (“needs, health service use, costs and health-related quality of life in a large sample of oldest old primary care patients [85+]”) with participating study centers in Bonn, Düsseldorf, Hamburg, Leipzig, Mannheim, and Munich. Data from AgeQualiDe originate from the AgeCoDe cohort (German Study on Ageing, Cognition and Dementia in Primary Care Patients), which started in 2003 and ended with the last assessment in 2013. Detailed description of the AgeCoDe sample selection process and the recruitment strategy for the AgeQualiDe study can be read elsewhere [16].

Figure 1 provides an overview of the sample selection. Additional exclusion criteria were applied for the present study: incomplete (≥ 1 item missing) or no CANE assessment, missing values in the Structured Interview for the Diagnosis of Dementia of the Alzheimer Type, Multi-Infarct Dementia, and Dementia of Other Etiology (SI-

DAM) cognitive score (SISCO), or the Lubben Social Network Scale (LSNS-6). Finally, the analytical sample size included 716 primary care patients at baseline.

Procedure and Instruments

The standardized clinical and neuropsychological interviews were conducted at the patients’ homes. The interview included the German version of the Camberwell Assessment of Need for the Elderly (CANE) [10], a standardized instrument for the assessment of care needs of elderly people. There are 24 items assessing patient needs and two items assessing caregiver needs in four categories of needs (environmental, physical, psychological, and social needs). In this study, the focus was on the patient’s perspective and responses were categorized as “no need,” “met need,” or “unmet need.” Given the focus of AgeQualiDe on the oldest old patients aged 85+ years and their associated disease burden, the interview was limited in time from the outset. Thus, 18 of the 24 CANE needs items were included in the study, excluding the items behavior, alcohol, deliberate self-harm, accidental self-harm, psychotic symptoms, and abuse/neglect. The exclusion of these items was based on the fact that these symptoms and related needs usually coincide with more severe cognitive impairment and dementia, whereas the current study focused on the milder forms of the disease.

The neuropsychological part of the interview involved the German version of the SIDAM according to DSM-III-R, DSM-IV, and ICD-10 [19]. The SIDAM enables the diagnosis and screening of dementia according to DSM-IV and MCI according to the consensus criteria proposed by the International Working Group on MCI [20]. The SIDAM is divided into (1) the SIDAM cognitive score (SISCO) with 55 items, including all 30 items of the MMSE, (2) the SIDAM-ADL with 14 items for measuring activities of daily living, and (3) the Hachinski-Rosen scale for differentiating major types of dementia, such as primary degenerative, vascular or multi-infarct, and mixed type [21, 22]. In this study, the diagnosis of dementia and MCI relied on a consensus conference involving the interviewer and a geriatrician or geriatric psychiatrist, following DSM-IV criteria. These criteria are integrated into the SIDAM as a diagnostic algorithm and were used to differentiate between unimpaired (i.e., cognitively healthy), MCI, and dementia.

Frailty was classified using the Clinical Frailty Scale [23] developed for the Canadian Study of Health and Aging (CSHA-CFS). This scale is a global assessment of frailty by the interviewer on a 7-point scale ranging from 1 (very fit) to 7 (severely frail). Following previous investigations, frailty was determined by a CFS score ≥ 5 [24].

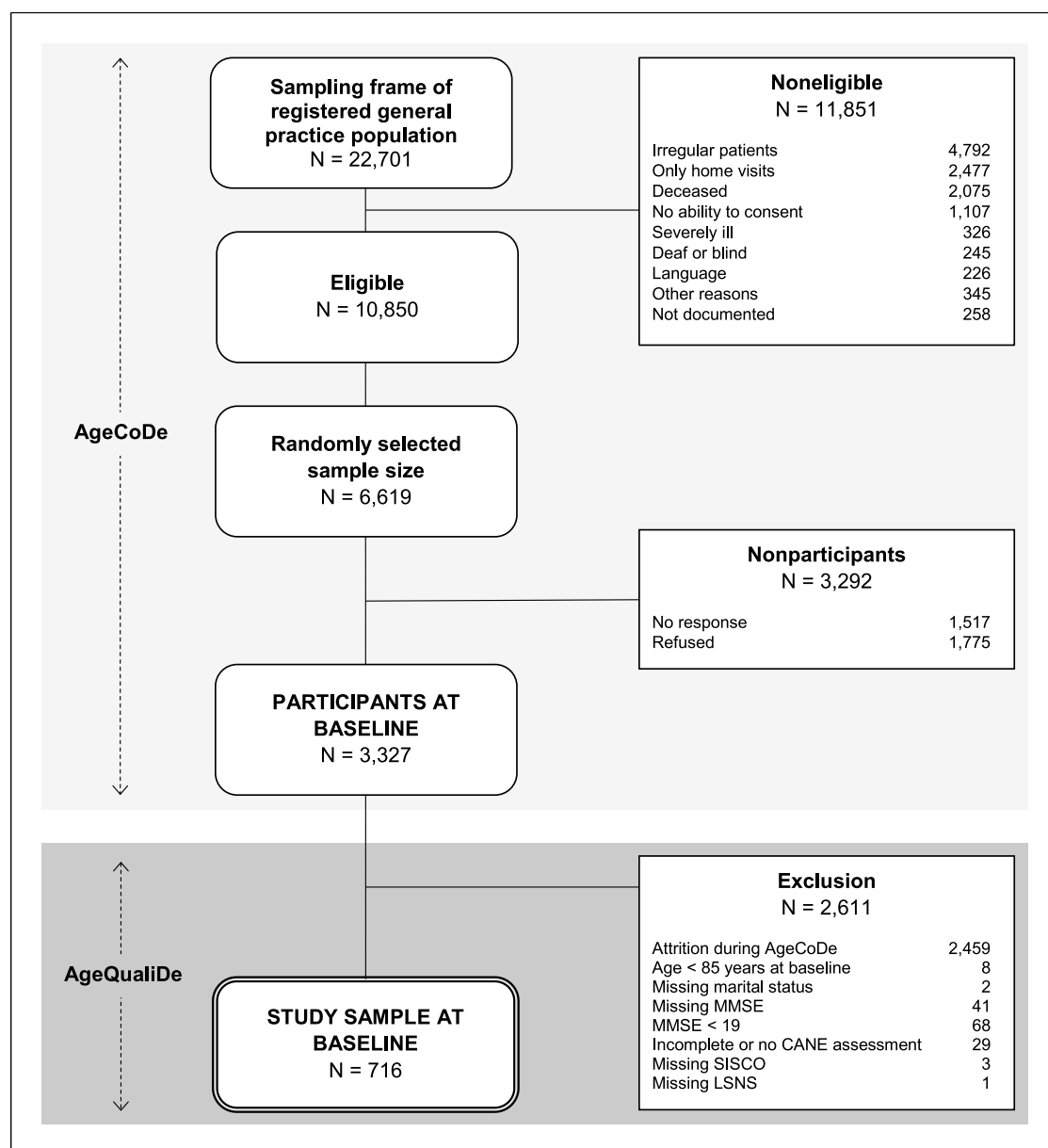


Fig. 1. Flowchart of sample selection.

Furthermore, the LSNS-6 [25] was used to assess the social network of family and friends of older adults. The questionnaire comprises six items on the type, closeness, and frequency of social contacts. The sum score ranges from 0 to 30, with higher scores representing stronger social networks.

Sociodemographic characteristics like age, gender, and marital status with single and divorced individuals grouped into one category (married, single/divorced, widowed) were recorded for statistical analyses. In addition, the educational level (low, middle, high) of the

elderly was categorized according to the CASMIN classification of education [26]. The type of residence, summarized as domicile (living “alone in private household,” “with partner,” “with relatives,” “with others,” “assisted living,” living in a “retirement home,” living in a “nursing home”), was also determined. Due to small subsample sizes, the categories living “with partner,” “with relatives,” and “with others” were grouped into one category, whereas “assisted living” and living in a “retirement home” or “nursing home” were collapsed into “assisted living/living in institutions.”

Table 1. Sociodemographic and clinical characteristics of the patient sample

	Total sample (N = 716)	Unimpaired patients (n = 575, 80.3%)	MCI patients (n = 97, 13.5%)	p value ¹	Dementia patients (n = 44, 6.2%)	p value ¹
Age, years						
Mean (SD)	88.8 (2.9)	88.6 (2.7)	89.9 (3.7)	0.002	89.3 (3.0)	0.152
Range	85–100	85–99	85–100		85–95	
Gender, n (%)				0.877		0.152
Male	234 (32.7)	191 (33.2)	33 (34.0)		10 (22.7)	
Female	482 (67.3)	384 (66.8)	64 (66.0)		34 (77.3)	
Education ² , n (%)				<0.001		0.853
High	103 (14.4)	83 (14.4)	15 (15.5)		5 (11.4)	
Middle	220 (30.7)	153 (26.6)	55 (56.7)		12 (27.3)	
Low	393 (54.9)	339 (59.0)	27 (27.8)		27 (61.4)	
Marital status, n (%)				0.04		0.436
Married	178 (24.9)	155 (27.0)	15 (15.5)		8 (18.2)	
Single/divorced	81 (11.3)	65 (11.3)	10 (10.3)		6 (13.6)	
Widowed	457 (63.8)	355 (61.7)	72 (74.2)		30 (68.2)	
Domicile, n (%)				0.04		<0.001
Alone in private household	364 (50.8)	303 (52.7)	47 (48.5)		14 (31.8)	
Living together with partner/relatives/others	224 (31.3)	188 (32.7)	26 (26.8)		10 (22.7)	
Assisted living/living in institutions	128 (17.9)	84 (14.6)	24 (24.7)		20 (45.5)	
MMSE, mean (SD)	27.6 (2.3)	28.2 (1.6)	26.2 (2.0)	<0.001	22.5 (2.1)	<0.001
Range	19–30	19–30	19–30		19–27	
SISCO, mean (SD)	48.4 (5.0)	49.9 (3.5)	44.3 (4.2)	<0.001	37.0 (4.1)	<0.001
Range	26–55	35–55	34–53		26–44	
CSHA-CFS, n (%)						
Frail ≥ 5				<0.001	33 (75.0)	<0.001
Range 1–4	257 (35.9)	173 (30.1)	51 (52.6)			
Non-frail < 5					11 (25.0)	
Range 5–7	459 (64.1)	402 (69.9)	46 (47.4)			
LSNS-6, mean (SD)	13.8 (5.4)	14.3 (5.3)	12.4 (5.3)	0.001	11.1 (4.9)	<0.001
Range	0–29	0–29	2–28		3–24	

SD, standard deviation; MCI, mild cognitive impairment; MMSE, Mini-Mental-State Examination; SISCO, global score of the Structured Interview for the Diagnosis of Dementia of the Alzheimer Type, Multi-Infarct Dementia and Dementia of Other Etiology according to DSM-III-R, DSM-IV, and ICD-10 (SIDAM); CSHA-CFS, Canadian Study of Health and Aging-Clinical Frailty Scale; LSNS-6, Lubben Social Network Scale. ¹Comparison with unimpaired patients based on Pearson χ^2 tests, *t* tests, or Mann-Whitney U test, as appropriate. ²Educational classification according to the new CASMIN educational classification: low = inadequately completed general education, general elementary education, basic vocational qualification or general elementary education and vocational qualification; middle = intermediate vocational qualification or intermediate general qualification and vocational qualification, intermediate general qualification, general maturity certificate, vocational maturity certificate/general maturity certificate and vocational qualification; high = lower tertiary education – general diplomas/diplomas with vocational emphasis, higher tertiary education – lower level/higher level.

Statistical Analyses

The statistical analyses were performed using Stata 16.0 SE (StataCorp LLC, College Station, TX), a software program that has been demonstrated to be statistically sound and has been successfully utilized at the Institute

of Social Medicine, Occupational Health, and Public Health (ISAP) [27]. Descriptive values (means, standard deviations, and percentages) were calculated for socio-demographic, psychosocial, and clinical characteristics of the patient sample. A comparison of MCI and

Table 2. Goodness-of-fit statistics for latent class models of needs

	LL	df	AIC	BIC	Entropy
1-class model	−2,688.631	10	5,397.262	5,442.999	–
2-class model	−2,555.444	21	5,152.889	5,248.936	0.666
3-class model	−2,517.842	32	5,099.684	5,246.042	0.825
4-class model	−2,511.277	43	5,108.554	5,305.222	0.745
5-class model	2,502.244	42	5,088.488	5,280.583	0.700

N = 716. Bold text indicates the preferred model. LL, log likelihood; df, degrees of freedom; AIC, Akaike information criterion; BIC, Bayesian information criterion.

dementia patients with unimpaired patients was based on Pearson χ^2 tests, *t* tests, or Mann-Whitney U tests, as appropriate.

Latent Class Analysis

Responses to the CANE were analyzed using LCA to divide the patterns into separable underlying subgroups (classes). The selection of indicator variables for the LCA model relied on CANE items exhibiting a comparatively high number of unmet needs across all needs, aligning with the focus of this study. In addition, LCA requires variation in participants' responses (in this case, no, met, or unmet need), which led to the exclusion of items with the smallest percentage of unmet needs. Thus, from the original 18 CANE items, we began to include 13 items, each of which covered 1% of the unmet needs. Finally, it was possible to retain five indicators, each covering $\geq 5\%$ of unmet needs: physical health, eyesight/hearing/communication, mobility/falls, company, and looking after home.

In an iterative process to fit the model with the optimal number of classes, models with increasing number of classes from 1 to 5 were tested. For each k-class model, multiple sets of random starting values were used to prevent local maxima [28]. Model fit (lowest value of Bayesian information criterion [BIC]), class distinction and classification accuracy (entropy score >0.80), interpretability of classes, and model parsimony were considered for the selection of the final model [29, 30]. Item-response probabilities were labeled as low ($<40\%$), moderate (40–69%), and high (70–100%) [15]. The final model was used to assign participants to classes based on their posterior class membership probabilities. The labeling of classes depends on qualitative and characteristic differences among them [31]. Therefore, we relied on the most distinctive features of each class compared to the others, aligning with the concept of intergroup heterogeneity [32]. Differences between the resulting classes in

terms of sociodemographic, psychosocial, and clinical characteristics were computed using Pearson χ^2 tests, ANOVA, or the Kruskal-Wallis test, as appropriate.

Multinomial Logistic Regression

A hierarchical multinomial logistic regression analysis was used to model the relationship between the elaborated need profiles (classes) and the cognitive disorder (unimpaired, MCI, dementia). To control for other variables assumed to be associated with cognitive disorders, covariates were added to the analysis in a hierarchical order: the first model included only the need profiles. The second model added the sociodemographic characteristics age, gender, education, marital status, and domicile. Finally, the third model took into account all variables including the social network (LSNS-6) and frailty (CSHA-CFS). Higher level models were tested against the lower level models using the likelihood ratio test (LRT). The significance level was $\alpha \leq 0.05$ for all calculations.

Results

Study Sample Characteristics

Cognitive assessment of the sample revealed unimpaired cognitive functioning in the majority ($n = 575$, 80.3%) of patients. A subgroup of 97 patients (13.5%) was diagnosed with MCI, and 44 patients (6.2%) were diagnosed with dementia at AgeQualiDe baseline. Descriptive statistics on the sociodemographic, psychosocial, and clinical characteristics of the groups are compared in Table 1. With regard to the overall sample, the average age was 88.8 (SD = 2.9) years, with around two-thirds of the patients being female. MCI patients were significantly older ($z = -3.0$; $p < 0.01$), better educated ($\chi^2 = 39.1$; $df = 2$; $p < 0.001$), more often widowed ($\chi^2 = 6.4$; $df = 2$; $p < 0.05$), and institutionalized or in assisted

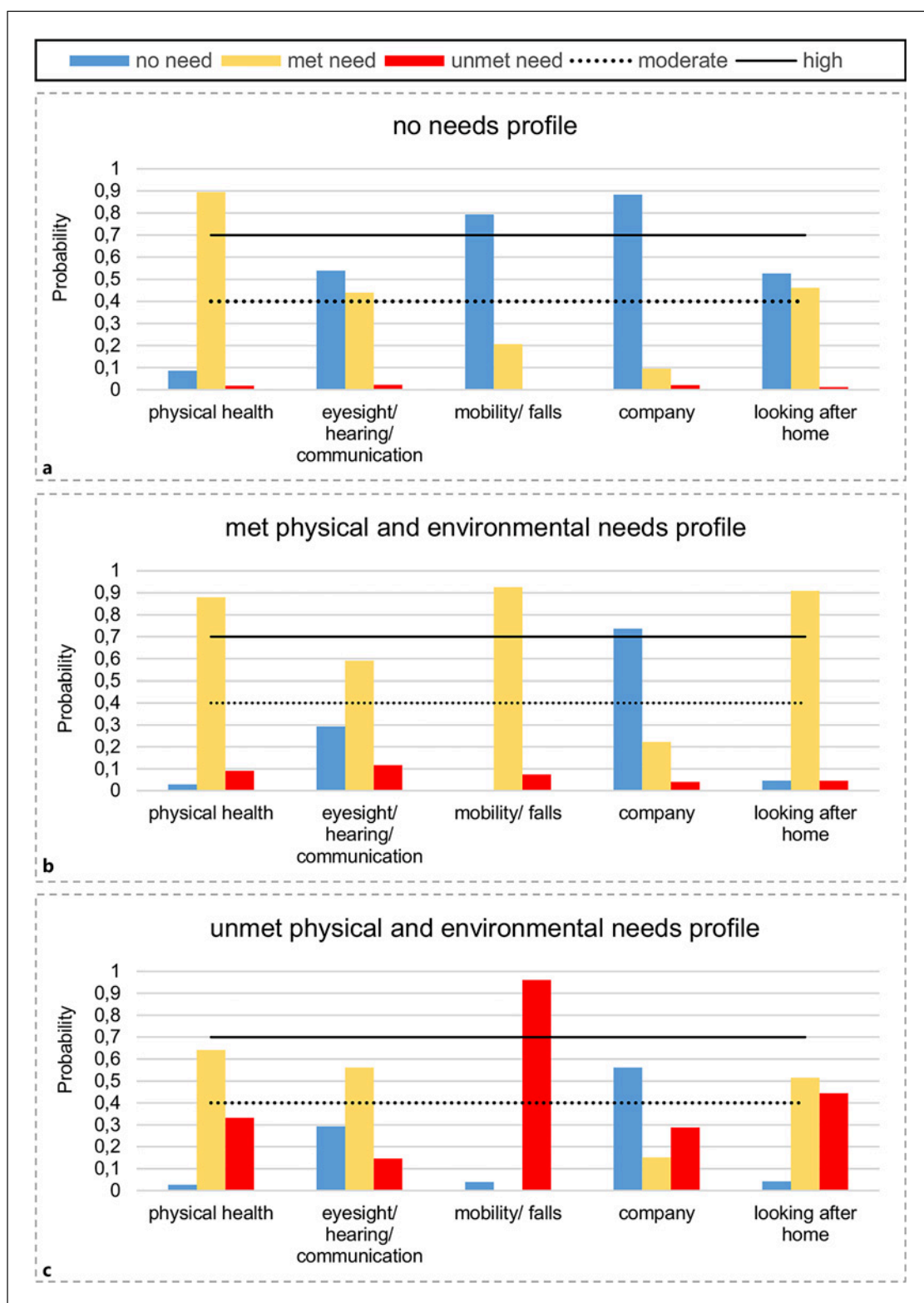


Fig. 2. Item-response probabilities of the three need profiles.

Table 3. Sociodemographic and clinical characteristics by need profiles

	No needs profile (<i>n</i> = 344, 48.1%)	Met physical and environmental needs profile (<i>n</i> = 321, 44.8%)	Unmet physical and environmental needs profile (<i>n</i> = 51, 7.1%)	Test statistics ¹
Age, mean (SD), years Range	88.1 (2.5) 85–99	89.5 (3.1) 85–100	89.7 (3.1) 85–99	$\chi^2 = 45.0^{**}$
Gender, <i>n</i> (%)				$\chi^2 = 6.2$
Male	128 (37.2)	92 (28.7)	14 (27.5)	
Female	216 (62.8)	229 (71.3)	37 (72.6)	
Education ² , <i>n</i> (%)				$\chi^2 = 3.9$
High	58 (16.9)	40 (12.5)	5 (9.8)	
Middle	99 (28.8)	104 (32.4)	17 (33.3)	
Low	187 (54.4)	177 (55.1)	29 (56.9)	
Marital status, <i>n</i> (%)				$\chi^2 = 18.2^*$
Married	108 (31.4)	61 (19.0)	9 (17.7)	
Single/divorced	33 (9.6)	38 (11.8)	10 (19.6)	
Widowed	203 (59.0)	222 (69.2)	32 (62.8)	
Domicile, <i>n</i> (%)				$\chi^2 = 39.2^{***}$
Alone in private household	188 (54.7)	155 (48.3)	21 (41.2)	
Living together with partner/relatives/ others	124 (36.1)	89 (27.7)	11 (21.6)	
Assisted living/living in institutions	32 (9.3)	77 (24.0)	19 (37.3)	
MMSE, mean (SD) Range	27.9 (2.0) 19–30	27.3 (2.3) 19–30	26.9 (3.0) 19–30	$\chi^2 = 15.3^{**}$
SISCO, mean (SD) Range	49.3 (4.6) 27–55	47.8 (5.1) 26–55	46.0 (5.9) 31–55	$\chi^2 = 28.1^{**}$
CSHA-CFS, <i>n</i> (%)				
Frail ≥ 5				
Range 1–4	23 (6.7)	188 (58.6)	46 (90.2)	$\chi^2 = 264.6^{***}$
Non-frail < 5				
Range 5–7	321 (93.3)	133 (41.4)	5 (9.8)	
LSNS-6, mean (SD) Range	14.5 (5.5) 0–29	13.8 (5.0) 2–27	9.8 (4.8) 3–20	$F = 17.6^{***}$

SD, standard deviation; MCI, mild cognitive impairment; MMSE, Mini-Mental-State Examination; SISCO, global score of the Structured Interview for the Diagnosis of Dementia of the Alzheimer Type, Multi-Infarct Dementia and Dementia of Other Etiology according to DSM-III-R, DSM-IV, and ICD-10 (SIDAM); CSHA-CFS, Canadian Study of Health and Aging-Clinical Frailty Scale; LSNS-6, Lubben Social Network Scale. ¹Comparison of need profiles are based on Pearson χ^2 tests, ANOVA, or Kruskal-Wallis test, as appropriate. ²Educational classification according to the new CASMIN educational classification: low = inadequately completed general education, general elementary education, basic vocational qualification or general elementary education and vocational qualification; middle = intermediate vocational qualification or intermediate general qualification and vocational qualification, intermediate general qualification, general maturity certificate, vocational maturity certificate/general maturity certificate and vocational qualification; high = lower tertiary education – general diplomas/diplomas with vocational emphasis, higher tertiary education – lower level/higher level. * $p < 0.01$. ** $p < 0.001$. *** $p < 0.0001$.

livings ($\chi^2 = 6.5$; $df = 2$; $p < 0.05$). There were no such differences for dementia patients, except for domicile, where the comparatively highest percentage lived in as-

sisted livings or institutions ($\chi^2 = 27.9$; $df = 2$; $p < 0.001$). Differences in clinical and psychosocial characteristics were observed in both MCI and dementia patients in

Table 4. Multinomial logistic regression analysis for the prediction of cognitive disorders

	MCI ^a									Dementia ^a								
	model 1			model 2			model 3			model 1			model 2			model 3		
	RRR	p value	95% CI	RRR	p value	95% CI	RRR	p value	95% CI	RRR	p value	95% CI	RRR	p value	95% CI	RRR	p value	95% CI
Need profiles ^b																		
Met physical and environmental needs	2.40	<0.001	1.486; 3.875	1.923	0.013	1.148; 3.223	1.536	0.160	0.844; 2.795	2.103	0.039	1.038; 4.261	1.551	0.250	0.734; 3.275	0.582	0.257	0.228; 1.483
Unmet physical and environmental needs	4.166	<0.001	1.928; 9.000	3.501	0.003	1.534; 7.994	1.955	0.176	0.741; 5.161	6.969	<0.001	2.752; 17.646	4.431	0.003	1.649; 11.909	0.892	0.852	0.264; 2.959
Constant	0.96	<0.001								0.043	<0.001							
Age				1.087	0.029	1.009; 1.171	1.074	0.063	0.996; 1.158				1.015	0.797	0.907; 1.136	0.994	0.911	0.889; 1.111
Male				1.395	0.253	0.789; 2.468	1.374	0.279	0.773; 2.441				0.690	0.407	0.287; 1.658	0.687	0.406	0.284; 1.663
Education ^c																		
Low				0.369	0.007	0.179; 0.762	0.347	0.005	0.167; 0.721				0.898	0.839	0.317; 2.546	0.825	0.728	0.279; 2.440
Middle				1.705	0.124	0.864; 3.365	1.693	0.135	0.849; 3.376				0.996	0.994	0.323; 3.072	0.964	0.951	0.299; 3.105
Marital status ^d																		
Single/divorced				1.709	0.329	0.583; 5.007	1.344	0.598	0.448; 4.032				1.167	0.831	0.284; 4.787	0.859	0.834	0.206; 3.572
Widowed				2.626	0.024	1.136; 6.070	2.336	0.050	1.001; 5.450				1.291	0.665	0.406; 4.105	1.140	0.823	0.363; 3.583
Domicile ^e																		
Living with partner/relatives/others				1.565	0.221	0.764; 3.204	1.516	0.262	0.732; 3.137				1.659	0.364	0.556; 4.948	1.558	0.425	0.524; 4.628
Assisted living/ living in institutions				1.659	0.096	0.913; 3.012	1.462	0.220	0.797; 2.683				4.288	<0.001	2.005; 9.172	3.353	0.002	1.534; 7.327
Constant				0.000	0.002								0.008	0.343				
CSHA-CFS ^f							1.617	0.104	0.906; 2.884							6.287	<0.001	2.484; 15.913
LSNS-6							0.947	0.024	0.903; 0.993							0.922	0.024	0.859; 0.989
Constant							0.000	0.013								0.139	0.700	
LRT				<0.001			<0.001						<0.001			<0.001		

N = 716. MCI, mild cognitive impairment; CSHA-CFS, Canadian Study of Health and Aging-Clinical Frailty Scale; LSNS-6, Lubben Social Network Scale; RRR, relative risk ratio; CI, confidence interval; LRT, likelihood ratio test. ^aReference group for MCI and dementia: unimpaired. ^bReference group for need profiles: no need. ^cReference group for education: high. ^dReference group for marital status: married. ^eReference group for domicile: private household. ^fReference group: non-frail.

contrast to unimpaired patients (i.e., cognitively healthy), with MCI patients having lower mean scores ($U_{\text{MMSE}} = 11,275.5$; $p < 0.0001$; $U_{\text{SISCO}} = 8,275.5$; $p < 0.0001$; $t_{\text{LSNS-6}} = 3.2$; $df = 670$; $p < 0.01$) and dementia patients recording lowest scores on the MMSE ($U_{\text{MMSE}} = 435$; $p < 0.0001$), the SISCO ($U_{\text{SISCO}} = 226.5$; $p < 0.0001$), and the LSNS-6 ($t_{\text{LSNS-6}} = 3.8$; $df = 617$; $p < 0.0001$). The incidence of frailty was higher in MCI patients (52.6%) ($\chi^2 = 18.9$; $df = 1$; $p < 0.001$) and highest in dementia patients (75.0%) ($\chi^2 = 37.1$; $df = 1$; $p < 0.001$) compared to unimpaired patients (30.1%).

For patients with MCI, unmet needs were most frequently observed for the CANE items mobility/falls ($n = 21$; 21.7%), physical health ($n = 11$; 11.3%), and looking after home ($n = 10$; 10.3%). Needs of patients with dementia were most frequently unmet for the CANE items memory ($n = 14$; 31.8%), looking after home ($n = 13$; 30.0%), and mobility/falls ($n = 9$; 20.5%).

Latent Class Analysis

LCA was employed to model the responses of patients exhibiting a specific combination of no, met, and unmet needs into distinct latent subpopulations (classes). The goodness-of-fit statistics for the five latent class models of needs are listed in Table 2. Taking into account the aforementioned criteria of model fit, the 3-class model with the lowest BIC value and the highest entropy score of 0.825 fitted the data best. Nonstatistical factors such as interpretability and parsimony confirmed the choice of the 3-class model.

The item-response probabilities in each class are displayed in Figure 2. The largest class, labeled as “no needs” profile, included 48.1% of the sample. Members in this class were most likely to report no needs in all CANE categories except for physical health, which was rated as a met need. The second largest class (44.8% of the sample) was labeled the “met physical and environmental needs” profile, as members were highly likely to classify their needs as met in the areas of mobility/falls, looking after home, physical health, and eyesight/hearing/communication. Finally, the third and smallest class (7.1% of the sample) labeled the “unmet physical and environmental needs” profile was characterized by the comparatively highest probability of members stating unmet needs. The most frequent unmet need in this class was mobility/falls. Compared to the other classes, it is noticeable that members of this class were also more likely to indicate unmet needs in the areas of looking after home, physical health, and company.

Sociodemographic, Psychosocial, and Clinical Characteristics by Need Profiles

Table 3 provides an overview of the differences between the profiles in terms of sociodemographic, psychosocial, and clinical characteristics. Differences were found for all variables except gender and education. A closer look reveals major descriptive differences between the “no needs” profile and the “unmet physical and environmental needs” profile, with the values of the “met physical and environmental needs” profile often falling between the two. More specifically, patients belonging to the “unmet physical and environmental needs” profile were the oldest ($\chi^2 = 45.0$; $df = 2$; $p < 0.001$), most often single/divorced ($\chi^2 = 18.2$; $df = 4$; $p < 0.01$), institutionalized or in assisted livings ($\chi^2 = 39.2$; $df = 4$; $p < 0.001$). They had lowest scores on the MMSE ($\chi^2 = 15.3$; $df = 2$; $p < 0.001$), SISCO ($\chi^2 = 28.1$; $df = 2$; $p < 0.001$), and LSNS-6 ($F = 17.6$; $df = 2$; $p < 0.0001$) and were most often frail ($\chi^2 = 264.6$; $df = 2$; $p < 0.001$). Opposite characteristics were shown for members of the “no needs” profile.

Need Profiles as Cross-Sectional Predictors of Cognitive Disorders

The results of the hierarchical multinomial logistic regression analysis are presented in Table 4. Model 1 showed that the classification of needs was associated with MCI and dementia compared to cognitive unimpaired functioning. Regarding the relative risk for patients belonging to the “unmet physical and environmental needs” profile, having MCI is almost twice (RRR [relative risk ratio] = 4.166, 95% CI: 1.928–9.0) and having dementia is more than three times (RRR = 6.696, 95% CI: 2.752–17.646) the relative risk of patients belonging to the “met physical and environmental needs” profile (RRR = 2.4, 95% CI: 1.486–3.875; RRR = 2.103, 95% CI: 1.038–4.261).

In model 2, membership in the “met physical and environmental needs” profile was no longer associated with dementia, controlling for sociodemographic covariates (age, gender, education, marital status, and domicile). Instead, patients living in institutions or in assisted livings had a 4.3 times higher relative risk of suffering from dementia. Higher age (RRR = 1.087, 95% CI: 1.009–1.171) and widowhood (RRR = 2.626, 95% CI: 1.136–6.07) were associated with an elevated risk of having MCI. Interestingly, low education (0.369, 95% CI: 0.179–0.762) was associated with a lower risk of MCI compared to unimpaired cognitive functioning than high education. It should be noted, however, that the MCI algorithm used in this study considered the educational

level of the patients. Therefore, MCI is sensitive to education and the association between MCI and the educational level found in this study cannot be interpreted independently.

In the final model 3, the classification of needs was no longer associated with MCI nor with dementia. Including the covariate measuring the social network (LSNS-6) showed that higher scores on the LSNS-6 were associated with a lower relative risk of having MCI (RRR = 0.947, 95% CI: 0.903–0.993) and dementia (RRR = 0.922, 95% CI: 0.859–0.989) compared to cognitively unimpaired patients. In addition, frail patients were at 6.3-fold higher relative risk of developing dementia, but not MCI. The LRT compared the hierarchically nested models, revealing that model 3 best fits the data.

Discussion

This study provides new insights into the needs of oldest old GP patients with unimpairment (i.e., cognitively healthy), MCI, and dementia. To our knowledge, this is the first study that evaluated need profiles from the patients' perspective and their association with unimpairment, MCI, and dementia. Besides sociodemographic, psychosocial, and clinical characteristics, including the social network and the level of frailty, were taken into account. The responses in the CANE on the needs of the oldest old were grouped into three need profiles: "no needs," "met physical and environmental needs," as well as "unmet physical and environmental needs." The results showed that after adjustment for social network and frailty, profile membership in the "met physical and environmental needs" and the "unmet physical and environmental needs" profile was no longer associated with MCI or dementia. Instead, patients with no MCI or dementia had larger social networks. Moreover, frailty was associated with dementia.

The Need Profiles and Their Relationship to MCI and Dementia

Patients' physical needs were highly likely to be met in the two largest profiles: the profiles of "no needs" and "met physical and environmental needs". These results are consistent with a recent systematic review and meta-analytic study by Cheraghi et al. [33] which included 9 studies using the CANE with 2,200 participants with a mean age of 78.4 years. In their study, the highest percentage (45%) of met needs across studies was related to the physical needs dimension. Furthermore, the scoping review of 21 studies by Carvacho et al. [34] including people aged 60 and older using the CANE found that the

most commonly reported met needs occurred in the physical and environmental needs domains. These results are in line with our "met physical and environmental needs" profile, with members likely to have their physical health, eyesight/hearing/communication, mobility/falls, and looking after home needs met. However, differences in methodology limit the comparability of these results with ours: whereas Cheraghi et al. [33] and Carvacho et al. [34] focused on the frequency of CANE needs, the current study classified patients' needs responses according to specific combinations of no, met, and unmet needs via LCA. Janssen et al. [15] conducted a methodologically comparable study, using LCA to examine need profiles of 477 community-dwelling dyads of people with mild to moderate dementia and their caregivers. Similarly, Sung and Chan [17] investigated 266 older Singaporeans and their caregivers using LCA to examine distinct profiles of met and unmet care needs. Both studies identified a profile of patients whose social needs for company were likely to be unmet. In comparison, the results of our study on the profile of "unmet physical and environmental needs" indicate that the need for company is subthreshold but also tends to remain unmet. Nevertheless, a direct comparison with this study cannot be made as the patients' needs were assessed from the perspective of caregivers in both the above-mentioned studies. Previous research has repeatedly demonstrated a significant difference between the patient needs reported by caregivers and those reported by patients with cognitive impairment and dementia [14, 16, 35, 36]. On the one hand, the need for company among patients with MCI or dementia may be underestimated in the current study because cognitive disorders often include memory problems, resignation, denial or the desire to preserve autonomy, limiting the perception and rating of needs [14, 37, 38]. On the other hand, compared to our sample, the studies by Janssen et al. [15] and Sung and Chan [17] included patients with more severe cognitive impairment and dementia, as evidenced by lower average MMSE scores. Thus, the variation in need ratings between studies may be attributed to the lower social integration of patients with more severe dementia and cognitive impairment, which may lead to higher unmet social needs, such as company [39]. However, it is important to note that above a certain level of disease severity, the statements of third parties involved should be considered to complement and contextualize direct patient statements. Further research is necessary to investigate need profiles of patients with cognitive impairment and dementia at different levels of severity and from the perspectives of both the oldest old patients with MCI or dementia and their caregivers. This

will help validate our findings in different samples from a variety of perspectives.

Further analysis of the data revealed that, after adjustment for sociodemographic characteristics, profile membership remained strongly associated with both MCI and dementia. Specifically, patients whose physical and environmental needs were unmet had the highest rates of both MCI and dementia, and thus represented the most vulnerable group of patients. Previous studies showed that the severity of cognitive impairment and dementia was higher in patients reporting more unmet needs than their unimpaired counterparts [16, 40, 41]. As mentioned earlier, this may be explained by the unmet needs model which suggests that the increase in cognitive impairment associated with cognitive disorders such as MCI and dementia can severely impair a patient's ability to perceive and effectively communicate their needs to the environment, resulting in a variety of needs that may go unmet [7, 8]. Along with this, previous research indicated that social functioning (i.e., an individual's social interactions and connections in both society and their personal environment) may be impaired even in the earliest stages of the disease [42–45]. Established practices to improve patient-caregiver communication, including the use of memory aids (e.g., biographical information), education, activity programs, and caregiver training can be helpful in this context [46–49]. In this regard, examining the relationship between impaired social functioning and caregiver burden is of particular interest for future research.

The Role of the Social Network and Frailty in MCI and Dementia

Interestingly, the significance of belonging to either the “met physical and environmental needs” profile or the “unmet physical and environmental needs” profile for MCI and dementia disappeared with the inclusion of the covariates social network (LSNS-6) and frailty (CSHA-CFS). This may seem contradictory at first. However, a closer look reveals the overlap between the need profiles and the corresponding variables: the need for company tended to be unmet in the “unmet physical and environmental needs” profile and may have been underrated, because of, for example, denial, memory loss, stigma, and fear [38]. Therefore, the inclusion of the LSNS-6, which may be indirectly indicative of social needs such as company, may have explained the association between an unmet need for company and cognitive disorders. Overall, these findings align with previous studies showing that the social network and

dementia are related: on the one hand, a larger social network was found to be protective against dementia and may delay cognitive decline [50, 51]. On the other hand, social isolation was found to be associated with an accelerated cognitive decline and a higher rate of dementia [52–54]. In fact, social isolation belongs to one of the 12 modifiable risk factors for dementia highlighted by the World Health Organization (WHO) as a key component in reducing the number of dementia cases [55, 56]. There are several plausible mechanisms that may explain why a social network protects against dementia. One of these is related to the beneficial health effects of social contact as people who are socially active showed a healthier eating behavior, drink less alcohol, and take more exercise [57]. Moreover, a strong association between social isolation and several physical and mental health risk factors for dementia, such as hypertension, coronary heart disease, and depression, was found in many studies [56, 58, 59]. Finally, social participation may build cognitive reserve, which implies a greater cognitive adaptability of the brain to overcome the neuropathology associated with dementia [60–62]. Accordingly, social participation may exercise multiple cognitive domains (e.g., planning, memory, language) and thereby reduce vulnerability to cognitive decline in late life [61, 63]. A recent and internationally growing development in community-based healthcare to enhance social participation is the concept of social prescribing [64]. Specifically, with this approach, a GP can refer a patient to a link worker who matches the patient's individual (unmet) social needs with suitable social activities in their community [65, 66]. However, there is conflicting evidence on the effects of social interventions on cognition and little evidence on delaying or preventing dementia [62, 67–69]. Further research is needed to develop potentially more intensive social interventions aimed at reducing the risk of dementia in the oldest old [56, 69].

Regarding frailty, our results indicate a significantly higher likelihood of concurrent dementia. Membership in either the “met physical and environmental needs” or the “unmet physical and environmental needs” profile, as noted above, was no longer associated with dementia. Upon closer examination, frailty is likely to explain the unmet needs in the “unmet physical and environmental needs” profile, particularly in the domains of mobility/falls and looking after home. According to a scoping review of the Clinical Frailty Scale (CFS) by Church et al. [24], frailty was strongly associated with falls and functional decline, which may account for the unmet needs in the areas of mobility/falls and looking after home in our

study. Other studies have further linked frailty to hospitalization, delirium, and mortality [24, 70]. A number of epidemiological studies found a bidirectional significant relationship between frailty and cognitive decline [71]. Research on the mechanisms underlying this link ranges from hormones, diet, chronic inflammation, and cardiovascular risk to mental health problems, but more evidence is needed to support these hypotheses [71]. Our results do not permit conclusions about the direction or causality of this association and future longitudinal investigations would be desirable. However, previous studies indicated that frailty may serve as a good predictor of adverse health outcomes [24]. An assessment of frailty can assist clinicians in identifying the most vulnerable patients and determining which interventions (i.e., physical activity, nutritional interventions) may be most beneficial in addressing cognitive disorders at an early stage [72].

Strengths and Limitations

A strength of this study is the large sample size of 85-year-olds and older GP patients based on multicenter data from cities across Germany. The large sample size further enabled the use of LCA, a statistical approach that provides a more accurate understanding of the response patterns of subgroups within a sample. For the present study, LCA identified overlapping care needs (here need profiles) within a group of cognitively impaired patients and thus provided valuable information for the integrated and individually tailored care of the oldest old people with MCI and dementia. Finally, the results of this study with GP patients can be considered representative of the oldest old people aged 85 and older because the majority of the oldest old population is under regular GP care [73].

Certain limitations need to be considered when interpreting the results of our study. The cross-sectional design of this study restricts the ability to make causal or directional inferences. Therefore, no conclusions can be drawn regarding the direction or causality of the relationship between the need profiles and the occurrence of MCI or dementia. Longitudinal studies are necessary in the future to investigate the specific need profiles of the oldest old patients with MCI and dementia over time. It should also be noted that the unequal sample sizes of the unimpaired ($n = 575$, 80.3%), MCI ($n = 97$, 13.5%), and dementia ($n = 44$, 6.2%) patient groups limit the statistical power to detect a true effect for the smaller groups, in this case, MCI and dementia patients. Notwithstanding this limitation, this study succeeded in recruiting a relatively large sample of the oldest old

population, comprising individuals aged 85 years and older, a demographic sample that is typically very difficult to reach. Further research is required, including a larger sample of the oldest old patients with MCI and dementia, to enable a more accurate evaluation of the influence of need profiles on cognitive disorders and dementia. Furthermore, it is important to note that the generalizability of care needs in the oldest old population may be limited since this study only included 5 out of 24 need items from the CANE. The decision to include certain items was based on time constraints during the interview and methodological prerequisites of the LCA. Nevertheless, this study focused on the most urgent unmet care needs (i.e., CANE items) from the patients' perspective, considering the methodological prerequisites of the LCA related to the inclusion of the most frequently reported unmet needs of patients. Future studies could expand the analysis of the care needs of the oldest old with cognitive disorders by including additional need items or the complete CANE, as well as the perspectives of relatives and their GPs. Additionally, due to time restrictions and cognitive limitations of the study participants, the range of relevant sociodemographic, psychosocial, and clinical factors included in this study was limited. For example, the study participants primarily resided in private homes, either alone or with relatives or others. If the patient's condition allows, future studies could expand the surveys to other settings, such as assisted living facilities or nursing homes.

Conclusions and Future Directions

Integrated care for the oldest old patients with MCI and dementia should not only address met and unmet physical and environmental care needs but also support the maintenance or expansion of their social network. The concept of social prescribing by GPs can be helpful in this context. Additionally, the detection of frailty could be used to identify the most vulnerable oldest old patients for cognitive decline, thereby facilitating the implementation of targeted interventions tailored to the specific needs. For future research, it is recommended to consider a longitudinal study design including multiple perspectives when evaluating the need profiles of individuals with MCI and dementia, as perceptions and evaluations may differ among patients, their relatives, and healthcare professionals. This approach allows for a comprehensive understanding of their needs from multiple perspectives, forming a foundation for tailored needs-based interventions and personalized treatment.

Statement of Ethics

This study was reviewed and approved by the Ethics Committees at each of the participating site. All GPs and patients provided written informed consent. Study conduct was in accordance with the Helsinki Declaration of 1975 (revised 2008) and approved by the Local Ethics Committees of all six participating study centers (Hamburg: OB/08/02, 2817/2007, MC-390/13; Bonn: 050/02; 174/02, 258/07, 369/13; Mannheim: 0226.4/2002, 2007-253E-MA, 2013-662 N-MA; Leipzig: 143/2002, 309/2007, 333-1318112013; Düsseldorf: 2079/2002, 2999/2008, 2999; and München: 713/02, 713/02 E).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

This study was funded by the German Research Foundation (Grant No. STE 2235/3-1; project number: 502412194). The study/publication is part of the German Research Network on Dementia (KND), the German Research Network on Degenerative Dementia (KNDD; AgeCoDe), and the Health Service Research Initiative (AgeQualiDe), and was funded by the German Federal Ministry of

Education and Research (grants KND: 01GI0102, 01GI0420, 01GI0422, 01GI0423, 01GI0429, 01GI0431, 01GI0433, and 01GI0434; grants KNDD: 01GI0710, 01GI0711, 01GI0712, 01GI0713, 01GI0714, 01GI0715, and 01GI0716; grants Health Service Research Initiative: 01GY1322A, 01GY1322B, 01GY1322C, 01GY1322D, 01GY1322E, 01GY1322F, and 01GY1322G). We want to thank all participating patients and their GPs for their good collaboration.

Author Contributions

Conceptualization, study design, and project administration: H.B., M.P., A.F., S.G.R.-H., J.S., M.W., W.M., H.-H.K., M.S., and S.W. Data curation: B.W. and A.O. Investigation: M.P., C.B., W.M., M.S., T.M., D.L., J.W., K.H., and S.G.R.-H. Analyses and interpretation of results: S.K., A.P., and J.S. Writing – original draft preparation: A.P., S.G.R.-H., J.S., and S.K. Writing – review and editing and critical revision of the manuscript: all authors.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

References

- Aranda MP, Kremer IN, Hinton L, Zissimopoulos J, Whitmer RA, Hummel CH, et al. Impact of dementia: health disparities, population trends, care interventions, and economic costs. *J Am Geriatr Soc*. 2021;69(7):1774–83. <https://doi.org/10.1111/jgs.17345>
- Tifratene K, Robert P, Metelkina A, Pradier C, Dartigues JF. Progression of mild cognitive impairment to dementia due to AD in clinical settings. *Neurology*. 2015;85(4):331–8. <https://doi.org/10.1212/WNL.0000000000001788>
- Mitchell AJ, Shiri-Feshki M. Rate of progression of mild cognitive impairment to dementia - meta-analysis of 41 robust inception cohort studies. *Acta Psychiatr Scand*. 2009;119(4):252–65. <https://doi.org/10.1111/j.1600-0447.2008.01326.x>
- Blotenberg I, Hoffmann W, Thyrian JR. Dementia in Germany: epidemiology and prevention potential. *Dtsch Arztebl Int*. 2023;120(27-28):470–76. <https://doi.org/10.3238/arztebl.m2023.0100>
- Bohlken J, Riedel-Heller SG, Kostev K, Michalowsky B. Demenzdiagnosen in deutschen Hausarztpraxen – Ein Vergleich mit der Prävalenzschätzung für das Jahr 2021. *Psychiatr Prax*. 2024;51(01):45–8. <https://doi.org/10.1055/a-2160-2864>
- Rajan KB, Weuve J, Barnes LL, McAninch EA, Wilson RS, Evans DA. Population estimate of people with clinical Alzheimer's disease and mild cognitive impairment in the United States (2020–2060). *Alzheimers Dement*. 2021;17(12):1966–75. <https://doi.org/10.1002/alz.12362>
- Cohen-Mansfield J, Werner P. Environmental influences on agitation: an integrative summary of an observational study. In: *American journal of alzheimer's care and related disorders & research*. SAGE Publications; 1995.
- Cohen-Mansfield J, Dakheel-Ali M, Marx MS, Thein K, Regier NG. Which unmet needs contribute to behavior problems in persons with advanced dementia? *Psychiatry Res*. 2015;228(1):59–64. <https://doi.org/10.1016/j.psychres.2015.03.043>
- McIntyre D, Mooney G, Jan S. Need: what is it and how do we measure it? *The Practice Of Public Health*.
- Orrell M, Hancock G. CANE: Camberwell assessment of need for the elderly. London, Gaskell; 2004.
- Scarmeas N, Brandt J, Blacker D, Albert M, Hadjigeorgiou G, Dubois B, et al. Disruptive behavior as a predictor in Alzheimer disease. *Arch Neurol*. 2007;64(12):1755–61. <https://doi.org/10.1001/archneur.64.12.1755>
- Wadsworth LP, Lorus N, Donovan NJ, Locascio JJ, Rentz DM, Johnson KA, et al. Neuropsychiatric symptoms and global functional impairment along the alzheimer's continuum. In: *Dementia and geriatric cognitive disorders*. S. Karger AG; 2012.
- Zhen Z, Feng Q, Gu D. The impacts of unmet needs for long-term care on mortality among older adults in China. *J Disabil Pol Stud*. 2015;25(4):243–51. <https://doi.org/10.1177/1044207313486521>
- Curnow E, Rush R, Maciver D, Górská S, Forsyth K. Exploring the needs of people with dementia living at home reported by people with dementia and informal caregivers: a systematic review and Meta-analysis. *Aging Ment Health*. 2021;25(3):397–407. <https://doi.org/10.1080/13607863.2019.1695741>
- Janssen N, Handels RL, Kohler S, Goncalves-Pereira M, Marques MJ, Irving K, et al. Profiles of met and unmet needs in people with dementia according to caregivers' perspective: results from a European multicenter study. *J Am Med Dir Assoc*. 2020;21(11):1609–16.e1. <https://doi.org/10.1016/j.jamda.2020.05.009>
- Stein J, Pabst A, Luck T, Lühmann D, Hesser K, Jessen F, et al. Unmet care needs in the oldest old primary care patients with cognitive disorders: results of the AgeCoDe and AgeQualiDe study. *Dement Geriatr Cogn Disord*. 2017;44(1–2):71–83. <https://doi.org/10.1159/000478850>

- 17 Sung P, Chan AW-M. Care needs profiles and their association with caregiver strain among community-dwelling older adults with cognitive impairment. *Dement Geriatr Cogn Disord*. 2022;51(4):340–7. <https://doi.org/10.1159/000525999>
- 18 Nowell ZC, Thornton A, Simpson J. The subjective experience of personhood in dementia care settings. *Dement*. 2013;12(4):394–409. <https://doi.org/10.1177/1471301211430648>
- 19 Zaudig M, Hiller W. SIDAM: Strukturiertes Interview für die Diagnose einer Demenz vom Alzheimer Typ, der Multiinfarkt- (oder vaskulären. In: Demenz und Demenzen anderer Ätiologie nach DSM-III-R, DSM-IV und ICD-10, 1. Auflage. Bern: Verlag Hans Huber; 1996.
- 20 Winblad B, Palmer K, Kivipelto M, Jelic V, Fratiglioni L, Wahlund L-O, et al. Mild cognitive impairment – beyond controversies, towards a consensus: report of the international working group on mild cognitive impairment. *J Intern Med*. 2004;256(3):240–6. <https://doi.org/10.1111/j.1365-2796.2004.01380.x>
- 21 Rosen WG, Terry RD, Fuld PA, Katzman R, Peck A. Pathological verification of ischemic score in differentiation of dementias. *Ann Neurol*. 1980;7(5):486–8. <https://doi.org/10.1002/ana.410070516>
- 22 Pantoni L, Inzitari D. Hachinski's ischemic score and the diagnosis of vascular dementia: a review. In: The Italian journal of neurological sciences. Springer Science and Business Media LLC; 1993.
- 23 Rockwood K, Song X, MacKnight C, Bergman H, Hogan DB, McDowell I, et al. A global clinical measure of fitness and frailty in elderly people. *CMAJ*. 2005;173(5):489–95. <https://doi.org/10.1503/cmaj.050051>
- 24 Church S, Rogers E, Rockwood K, Theou O. A scoping review of the clinical frailty scale. *BMC Geriatr*. 2020;20(1):393. <https://doi.org/10.1186/s12877-020-01801-7>
- 25 Lubben J, Blozik E, Gillmann G, Iliffe S, von Renteln Kruse W, Beck JC, et al. Performance of an abbreviated version of the Lubben Social Network Scale among three European community-dwelling older adult populations. *Gerontologist*. 2006;46(4):503–13. <https://doi.org/10.1093/geront/46.4.503>
- 26 Brauns H, Steinmann S. Educational reform in France, West-Germany and the United Kingdom: updating the CASMIN educational classification. Mannheim; 1999.
- 27 StataCorp: Stata statistical software: release 16. College Station, TX: StataCorp LLC, 2019.
- 28 Masyn KE. Latent class analysis and finite mixture modeling. In: The Oxford handbook of Quantitative methods in psychology; volume 2: statistical methods. Oxford: Oxford University Press; 2013. p. 2013.
- 29 Nylund KL, Asparouhov T, Muthen BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Struct Equation Modeling-A multidisciplinary J*. 2007;14(4):535–69. <https://doi.org/10.1080/10705510701575396>
- 30 Clark SL, Muthén B. Relating latent class analysis results to variables not included in the analysis; 2009.
- 31 Nylund-Gibson K, Choi AY. Ten frequently asked questions about latent class analysis. *Translational Issues Psychol Sci*. 2018;4(4):440–61. <https://doi.org/10.1037/tps0000176>
- 32 Scotto Rosato N, Baer JC. Latent class analysis: a method for capturing heterogeneity. *Soc Work Res*. 2012;36(1):61–9. <https://doi.org/10.1093/swr/svs006>
- 33 Cheraghi P, Delbari A, Cheraghi Z, Karimi-Shahanjarini A, Zanjari N. Assessment of met and unmet care needs in older adults without mental disorders using the Camberwell assessment of need for the elderly: a systematic review and meta-analysis. *J Res Health Sci*. 2021;21(4):e00530. <https://doi.org/10.34172/jrhs.2021.64>
- 34 Carvacho R, Carrasco M, Lorca MBF, Miranda-Castillo C. Met and unmet needs of dependent older people according to the Camberwell Assessment of Need for the Elderly (CANE): a scoping review. *Rev Esp Geriatr Gerontol*. 2021;56(4):225–35. <https://doi.org/10.1016/j.regg.2021.02.004>
- 35 Miranda-Castillo C, Woods B, Orrell M. The needs of people with dementia living at home from user, caregiver and professional perspectives: a cross-sectional survey. *BMC Health Serv Res*. 2013;13:43. <https://doi.org/10.1186/1472-6963-13-43>
- 36 Hancock GA, Reynolds T, Woods B, Thornicroft G, Orrell M. The needs of older people with mental health problems according to the user, the carer, and the staff. *Int J Geriatr Psychiatry*. 2003;18(9):803–11. <https://doi.org/10.1002/gps.924>
- 37 Galeone F, Pappalardo S, Chieffi S, Iavarone A, Carlomagno S. Anosognosia for memory deficit in amnesic mild cognitive impairment and Alzheimer's disease. *Int J Geriatr Psychiatry*. 2011;26(7):695–701. <https://doi.org/10.1002/gps.2583>
- 38 Parker M, Barlow S, Hoe J, Aitken L. Persistent barriers and facilitators to seeking help for a dementia diagnosis: a systematic review of 30 years of the perspectives of carers and people with dementia. *Int Psychogeriatr*. 2020;32(5):611–34. <https://doi.org/10.1017/S1041610219002229>
- 39 Zunzunegui M-V, Alvarado BE, Del Ser T, Otero A, Networks S. Social networks, social integration, and social engagement determine cognitive decline in community-dwelling Spanish older adults. *J Gerontol B Psychol Sci Soc Sci*. 2003;58(2):S93–100. <https://doi.org/10.1093/geronb/58.2.s93>
- 40 van der Ploeg ES, Bax D, Boorsma M, Nijpels G, van Hout HPJ. A cross-sectional study to compare care needs of individuals with and without dementia in residential homes in The Netherlands. *BMC Geriatr*. 2013;13:51. <https://doi.org/10.1186/1471-2318-13-51>
- 41 Ferreira AR, Dias CC, Fernandes L. Needs in nursing homes and their relation with cognitive and functional decline, behavioral and psychological symptoms. *Front Aging Neurosci*. 2016;8:72. <https://doi.org/10.3389/fnagi.2016.00072>
- 42 Grothe J, Luppá M, Dietzel J, Schomerus G, Sommerlad A, Riedel-Heller SG, et al. Psychometric evaluation of the German version of the social functioning in dementia scale (SF-dem). *J Alzheimers Dis*. 2022;86(3):1231–41. <https://doi.org/10.3233/JAD-215557>
- 43 Henry JD, von Hippel W, Thompson C, Pulford P, Sachdev P, Brodaty H. Social behavior in mild cognitive impairment and early dementia. *J Clin Exp Neuropsychol*. 2012;34(8):806–13. <https://doi.org/10.1080/13803395.2012.683855>
- 44 Sommerlad A, Singleton D, Jones R, Banerjee S, Livingston G. Development of an instrument to assess social functioning in dementia: the Social Functioning in Dementia scale (SF-DEM). *Alzheimers Dement*. 2017;7:88–98. <https://doi.org/10.1016/j.dadm.2017.02.001>
- 45 Verdon C-M, Fossati P, Verny M, Dieudonné B, Teillet L, Nadel J. Social cognition: an early impairment in dementia of the alzheimer type. *Alzheimer Dis Assoc Disord*. 2007;21(1):25–30. <https://doi.org/10.1097/WAD.0b013e318032487a>
- 46 Egan M, Bérubé D, Racine G, Leonard C, Rochon E. Methods to enhance verbal communication between individuals with alzheimer's disease and their formal and informal caregivers: a systematic review. *Int J Alzheimer's Dis*. 2010;2010:906818. <https://doi.org/10.4061/2010/906818>
- 47 Bourgeois MS, Mason LA. Memory wallet intervention in an adult day-care setting. *Memory wallets: memory wallets. Behav Interv*. 1996;11(1). 3–18. [https://doi.org/10.1002/\(sici\)1099-078x\(199601\)11:1<3::aid-brt150>3.0.co;2-0](https://doi.org/10.1002/(sici)1099-078x(199601)11:1<3::aid-brt150>3.0.co;2-0)
- 48 Bowlby B. Therapeutic activities with persons disabled by Alzheimer's disease and related disorders. Gaithersburg, Md: Aspen Publishers; 1993.
- 49 Orange JB, Ryan EB, Meredith SD, MacLean MJ. Application of the communication enhancement model for long-term care residents with Alzheimer's disease. *Topics In Language Disorders*, Ovid Technologies; 1995.
- 50 Sommerlad A, Sabia S, Singh-Manoux A, Lewis G, Livingston G. Association of social contact with dementia and cognition: 28-year follow-up of the Whitehall II cohort study. *PLoS Med*. 2019;16(8):e1002862. <https://doi.org/10.1371/journal.pmed.1002862>
- 51 Hikichi H, Kondo K, Takeda T, Kawachi I. Social interaction and cognitive decline: results of a 7-year community intervention. *Alzheimers Dement*. 2017;3(1):23–32. <https://doi.org/10.1016/j.trci.2016.11.003>

- 52 Piolatto M, Bianchi F, Rota M, Marengoni A, Akbaritabar A, Squazzoni F. The effect of social relationships on cognitive decline in older adults: an updated systematic review and meta-analysis of longitudinal cohort studies. *BMC Public Health*. 2022;22(1):278. <https://doi.org/10.1186/s12889-022-12567-5>
- 53 Kuiper JS, Zuidersma M, Oude Voshaar RC, Zuidema SU, van den Heuvel ER, Stolk RP, et al. Social relationships and risk of dementia: a systematic review and meta-analysis of longitudinal cohort studies. *Ageing Res Rev*. 2015;22:39–57. <https://doi.org/10.1016/j.arr.2015.04.006>
- 54 Schomerus G. Einsamkeit und Isolation im Alter. *Psychiatr Prax*. 2023;50:450.
- 55 World Health Organization. Global action plan on the public health response to dementia 2017–2025; 2017.
- 56 Livingston G, Huntley J, Sommerlad A, Ames D, Ballard C, Banerjee S, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet*. 2020; 396(10248):413–46. [https://doi.org/10.1016/S0140-6736\(20\)30367-6](https://doi.org/10.1016/S0140-6736(20)30367-6)
- 57 Umberson D, Crosnoe R, Reczek C. Social relationships and health behavior across life course. *Annu Rev Sociol*. 2010;36: 139–57. <https://doi.org/10.1146/annurev-soc-070308-120011>
- 58 Cacioppo JT, Hawkey LC, Thisted RA. Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago Health, Aging, and Social Relations Study. *Psychol Aging*. 2010;25(2):453–63. <https://doi.org/10.1037/a0017216>
- 59 Hakulinen C, Pulkki-Råback L, Virtanen M, Jokela M, Kivimäki M, Elovainio M. Social isolation and loneliness as risk factors for myocardial infarction, stroke and mortality: UK Biobank cohort study of 479 054 men and women. *Heart*. 2018; 104(18):1536–42. <https://doi.org/10.1136/heartjnl-2017-312663>
- 60 Stern Y, Arenaza-Urquijo EM, Bartrés-Faz D, Belleville S, Cantilon M, Chetelat G, et al. Whitepaper: defining and investigating cognitive reserve, brain reserve, and brain maintenance. *Alzheimers Dement*. 2020; 16(9): 1305–11. <https://doi.org/10.1016/j.jalz.2018.07.219>
- 61 Scarmeas N, Stern Y. Cognitive reserve and lifestyle. *J Clin Exp Neuropsychol*. 2003; 25(5):625–33. <https://doi.org/10.1076/jcen.25.5.625.14576>
- 62 Sommerlad A, Kivimäki M, Larson EB, Röhr S, Shirai K, Singh-Manoux A, et al. Social participation and risk of developing dementia. *Nat Aging*. 2023;3(5):532–45. <https://doi.org/10.1038/s43587-023-00387-0>
- 63 Lanooij SD, Eisel ULM, Drinkenburg WHIM, van der Zee EA, Kas MJH. Influencing cognitive performance via social interactions: a novel therapeutic approach for brain disorders based on neuroanatomical mapping? *Molecular psychiatry*. 2023;28(1):28–33. <https://doi.org/10.1038/s41380-022-01698-1>
- 64 Bhatti S, Rayner J, Pinto AD, Mulligan K, Cole DC. Using self-determination theory to understand the social prescribing process: a qualitative study. *BJGP Open*. 2021;5(2). <https://doi.org/10.3399/BJGPO.2020.0153>
- 65 Khan and Giurca. Social prescribing around the world. A world map of global developments in social prescribing across different health system contexts; 2023. Available from: <https://socialprescribingacademy.org.uk/media/4lbdy5ip/social-prescribing-around-the-world.pdf>
- 66 Giebel C, Morley N, Komuravelli A. A socially prescribed community service for people living with dementia and family carers and its long-term effects on well-being. *Health Soc Care Community*. 2021;29(6): 1852–7. <https://doi.org/10.1111/hsc.13297>
- 67 Kelly ME, Duff H, Kelly S, McHugh Power JE, Brennan S, Lawlor BA, et al. The impact of social activities, social networks, social support and social relationships on the cognitive functioning of healthy older adults: a systematic review. *Syst Rev*. 2017;6(1):259. <https://doi.org/10.1186/s13643-017-0632-2>
- 68 McDermott O, Charlesworth G, Högervorst E, Stoner C, Moniz-Cook E, Spector A, et al. Psychosocial interventions for people with dementia: a synthesis of systematic reviews. *Ageing Ment Health*. 2019;23(4):393–403. <https://doi.org/10.1080/13607863.2017.1423031>
- 69 Zülke AE, Pabst A, Lupp A, Roehr S, Seidling H, Oey A, et al. A multidomain intervention against cognitive decline in an at-risk-population in Germany: Results from the cluster-randomized AgeWell.de trial. *Alzheimers Dement*. 2024;20(1):615–28. <https://doi.org/10.1002/alz.13486>
- 70 Hoogendijk EO, Afila J, Ensrud KE, Kowal P, Onder G, Fried LP. Frailty: implications for clinical practice and public health. *Lancet*. 2019;394(10206): 1365–75. [https://doi.org/10.1016/S0140-6736\(19\)31786-6](https://doi.org/10.1016/S0140-6736(19)31786-6)
- 71 Robertson DA, Savva GM, Kenny RA. Frailty and cognitive impairment—a review of the evidence and causal mechanisms. *Ageing Res Rev*. 2013;12(4):840–51. <https://doi.org/10.1016/j.arr.2013.06.004>
- 72 Woolford SJ, Sohan O, Dennison EM, Cooper C, Patel HP. Approaches to the diagnosis and prevention of frailty. *Ageing Clin Exp Res*. 2020;32(9):1629–37. <https://doi.org/10.1007/s40520-020-01559-3>
- 73 Linden M, Horgas AL, Gilberg R, Steinhagen-Thiessen E. Predicting health care utilization in the very old. The role of physical health, mental health, attitudinal and social factors. *J Aging Health*. 1997;9(1):3–27. <https://doi.org/10.1177/089826439700900101>