



Research paper

Profiles of met and unmet care needs in the oldest-old primary care patients with depression – results of the AgeMooDe study

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ABSTRACT

Background: Unmet care needs have been associated with an increased risk of depression in old age. Currently, the identification of profiles of met and unmet care needs associated with depressive symptoms is pending. Therefore, this exploratory study aimed to identify profiles of care needs and analyze associated factors in oldest-old patients with and without depression.

Methods: The sample of 1092 GP patients aged 75+ years is based on the multicenter study “Late-life depression in primary care: needs, health care utilization and costs (AgeMooDe)”. Depression (i.e. clinically meaningful depressive symptoms) was determined using the Geriatric Depression Scale (GDS) (cutoff score ≥ 4). Needs of patients were assessed using the Camberwell Assessment of Need for the Elderly (CANE). Associated socio-demographic and clinical factors were examined, and latent class analysis identified the need profiles.

Results: The main result of the study indicates three need profiles: ‘no needs’, ‘met physical needs’, and ‘unmet social needs’. Members of the ‘met physical needs’ (OR = 3.5, 95 %-CI: 2.5–4.9) and ‘unmet social needs’ (OR = 17.4, 95 %-CI: 7.7–39.7) profiles were significantly more likely to have depression compared to members of the ‘no needs’ profile.

Limitations: Based on the cross-sectional design, no conclusions can be drawn about the causality or direction of the relationships between the variables.

Conclusions: The study results provide important insights for the establishment of needs-based interventions for GPs. Particular attention should be paid to the presence of unmet social needs in the oldest-old GP patients with underlying depressive symptoms.

1. Introduction

Increasing life expectancy is leading to a growing population of the oldest-old. This poses major challenges for healthcare systems, mainly due to the age-related increase in individual disease risk and multimorbidity, demanding complex care (Deschodt et al., 2020; Roller-Wirnsberger et al., 2020). Depression belongs to the most common

disorders in old age. According to a recent meta-analysis, the worldwide prevalence of depressive disorders in old age is 13.3 % (Abdoli et al., 2022). Affected individuals often require specific and tailored care due to a combination of negative consequences such as increased suicidality, loneliness, impaired physical, cognitive and social functioning (Sinyor et al., 2016; Köhler et al., 2018; Domènech-Abella et al., 2019; Muhammad and Meher, 2021). However, the associated care needs of

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depressed patients often remain unmet (Dezetter et al., 2015; Stein et al., 2016). An unmet need refers to a specific problem of an individual that is not being addressed with an appropriate intervention (Orrell and Hancock, 2004). Numerous studies, including a meta-analysis, conducted in various cultural contexts have consistently highlighted the significant impact of unmet needs on depression, and vice versa (Stein et al., 2016; Carvacho et al., 2021; Jung and Ha, 2021; Shah et al., 2021; Eimontas et al., 2022; Khattar et al., 2022). Stein et al. (2016) showed in a previous cross-sectional study based on 1179 oldest-old German GP patients, that those who reported unmet needs were 3.7 times more likely to also report depressive symptoms. Similarly, a longitudinal study conducted by Eimontas et al. (2022) found a direct relationship between past and present unmet health care needs and depression in a large multicultural sample of 39,484 people aged 50–100 years. This relationship persisted even after controlling for established risk factors such as age, gender, financial situation, and functional limitations (Eimontas et al., 2022; Ferri et al., 2023). The link between unmet needs and depressive symptoms might be explained through several pathways, including the added stress of not receiving the necessary services and the emergence of psychological distress, including frustration, anger, and helplessness (Martínez Arroyo et al., 2019). One of the reasons for the high occurrence of unmet needs in patients with depression could also be explained by the phenomenon that depression in the older adults is often masked by physical symptoms (Kok and Reynolds, 2017). Moreover, it appears that general practitioners (GP) attribute several physical symptoms or even emotional symptoms to existing medical conditions rather than to comorbid depression (Tune, 2001; Gates et al., 2016). Consequently, the needs of older depressed patients may not be recognized and, as a result, may not be addressed in treatment. Unmet needs can in turn lead to further depressive symptoms, creating a vicious cycle (Eimontas et al., 2022). Therefore, addressing unmet needs at an early stage is crucial to prevent the potentially self-reinforcing depressive symptomatology in the oldest-old population.

The Camberwell Assessment of Need for the Elderly (CANE) assesses the social, psychological, physical, and environmental needs of old patients, thus providing a detailed insight into their met and unmet needs (Orrell and Hancock, 2004). Previous studies using CANE mainly focused on the distribution (including frequencies or sum scores) of unmet needs in depressed patients, which were found highest in the areas of physical health, mobility/falls, daytime activities, company, and psychological distress (Houtjes et al., 2011; Stein et al., 2016). Recently, there have been research efforts focusing on different need profiles in old patients suffering from cognitive impairment and dementia (Janssen et al., 2020; Sung and Chan, 2022). In these studies, latent class analysis (LCA) was employed to determine latent classes of needs, which were referred to as need profiles. LCA is a person-centered approach that assumes the existence of an unobserved (latent) categorical variable that divides the sample into distinct classes (Muthén and Muthén, 2000). Probabilities for class membership are calculated for each observation in all identified classes (profiles) based on a characteristic pattern of responses indicating, in this case, different combinations of no, met, or unmet needs (Sinha et al., 2021). Both the study by Janssen et al. (2020) and the study by Sung and Chan (2022) investigated the needs using the CANE from the caregivers' perspective and were able to identify four different need profiles. Other applications of LCA in the study of depression were predominantly related to groups of people with latent subtypes of depressive symptomatology (Ulbricht et al., 2018). In extension to former research, this is a promising approach as it considers heterogeneity and different patterns of individuals' needs, serving as a foundation for advancing integrated care concepts. Based on our knowledge, no published studies exist that have examined the individual combinations of met and/or unmet needs in the oldest-old with depression using LCA. Certain combinations of needs may form a needs profile that is associated with a particularly high risk of depression in the oldest-old.

Therefore, based on a large sample of GP patients aged 75 years and

older, the aims of this exploratory study were (1) to identify different combinations (profiles) of no, met, and unmet needs, (2) to further describe these need profiles in terms of sociodemographic and clinical characteristics, and (3) to examine the different need profiles in relation to the risk for depressive symptoms.

2. Methods

2.1. Sample

The study sample was based on data from the German AgeMooDe study ("Late-life depression in primary care: needs, health care utilization and costs"). In this multicenter prospective cohort study, participants were recruited in primary care practices between May 2012 and December 2013 in the cities of Leipzig, Bonn, Hamburg, and Mannheim. After baseline assessment, one follow-up assessment was conducted. The present study focused on cross-sectional data from the baseline assessment. Patients who (1) had an age of 75 years and older and (2) were a regular patient with at least one GP contact in the last 6 months were included in the study. Patients who (1) had a severe illness that is probably fatal within three months, (2) had moderate or severe dementia and (3) had insufficient skills in speaking and reading German or insufficient ability to consent were excluded from the study. A thorough description of the recruitment process can be read elsewhere (Stein et al., 2016). Originally, a sample of 1230 participants was assessed. As described in Fig. 1, 138 participants had to be excluded from the study, leading to the final analytical sample size of 1092 patients at baseline.

2.2. Ethics statement

Ethical approval was received from each participating center (Ethics approval Leipzig: 020–12-23,012,012). Prior to the investigation, all GPs and patients provided written informed consent. The ethical standards of this study are in accordance with the Helsinki Declaration of 1975 (revised 2008) and the relevant national and institutional committees on human experimentation.

2.3. Procedure and instruments

Trained interviewers visited the patients in their home environment and the German version of the Camberwell Assessment of Need for the Elderly (CANE) (Dech and Machleidt, 2004) was administered as part of the structured interview. The CANE consists of 24 need items which are nested into 4 domains of care needs. In addition, 2 more items are included that assess the person's caregiver needs (Orrell and Hancock, 2004). The 4 domains of care needs entail (1) environmental needs (2) physical needs (3) psychological needs and (4) social needs. The CANE can be answered from different perspectives, including the patient, the caregiver, GPs or external professionals. In this analysis, the patient perspective was examined, thereby excluding the two items assessing the needs of the caregiver. Based on the patient's response, the interviewer classified each need as "no needs", "met need" or "unmet need". Psychometric investigations of the German language-version of the CANE have proven its reliability and validity (Stein et al., 2014, 2015).

Depressive symptoms of the oldest-old participants were analyzed by means of the Geriatric Depression Scale (GDS) (Gauggel and Birkner, 1999). Here, the short version consisting of 15 items with "yes" or "no" responses was applied. Depression (i.e. clinically meaningful depressive symptoms) was determined by a GDS-score ≥ 4 , as proposed by Allen and Annells (2009).

Moreover, the ADL/IADL (instrumental activities of daily living) was implemented to measure a range of functional (dis-)abilities in the patient's daily life. In total, 24 items cover different areas of daily living (e.g., food preparation, housekeeping, body care, handle finances) that indicate the level of functioning (Schneekloth and Potthoff, 1993). Patients with functional impairment had difficulties in at least one of the

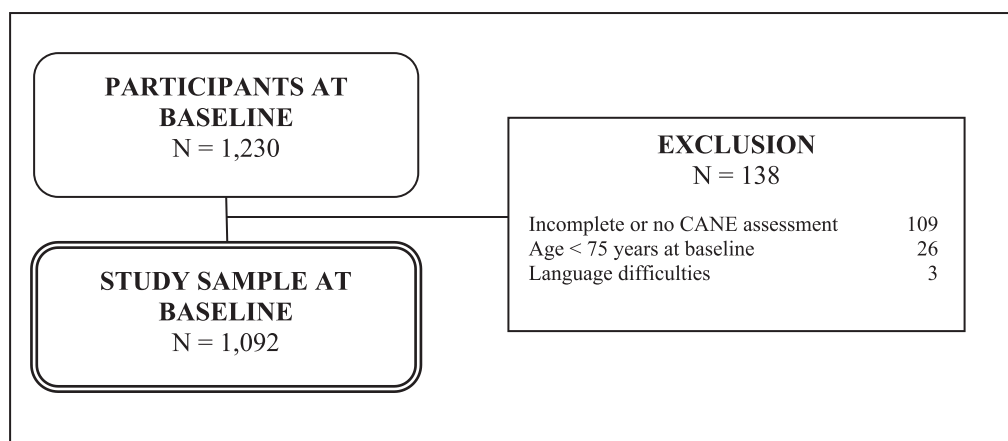


Fig. 1. Flow chart of sample selection.

24 items of ADL/IADL.

Sociodemographic characteristics were collected for age, gender and marital status (married/with spouse, married/living apart, single, divorced, widowed). For statistical analyses, the marital status “single” and “divorced” was collapsed into one category. In addition, the level of education was categorized as low/medium/high according to the CASMIN classification of education (Brauns and Steinmann, 1999). Furthermore, domicile (living “alone in private household”, “together with partner”, “with relatives”, “with others in private household”, in a “retirement home”, in a “nursing home”) was specified. Due to small subsample sizes, the categories living “with relatives” and “with others in private household” were combined and living in a “retirement home”

and in a “nursing home” merged into “living in institutions”. Lastly, the participants were asked to indicate whether they are cared for by a relative (yes/no).

2.4. Statistical analyses

Data processing and statistical analyses were conducted using Stata 16.0 SE (StataCorp LLC, College Station, TX). Means, standard deviations or percentages were calculated for sociodemographic characteristics of the study sample. Further, group differences (depressive/non-depressive) were tested using Pearson chi-square and Mann-Whitney *U* tests, as appropriate.

Table 1
Sociodemographic and clinical characteristics of the patient sample.

	Patients			
	Total sample (N = 1092)	Non-depressive (n = 774, 70.9 %)	Depressive (n = 318, 29.1 %)	p-value ¹
Age (in years)				
Mean (SD)	80.7 (4.6)	80.4 (4.4)	81.3 (4.9)	<0.050
Range	75–98	75–98	75–96	
Gender (n, (%))				< 0.001
Male	403 (36.9)	311 (40.2)	92 (28.9)	
Female	689 (63.1)	463 (59.8)	226 (71.1)	
Education ²				0.003
High	206 (18.6)	166 (21.5)	40 (12.6)	
Middle	281 (25.7)	190 (24.5)	91 (28.6)	
Low	605 (55.4)	418 (54.0)	187 (58.8)	
Marital Status (n, (%))				0.004
Married/with spouse	506 (46.3)	390 (49.7)	125 (39.1)	
Married/living apart	22 (2.0)	17 (2.2)	5 (1.6)	
Single/Divorced	107 (9.8)	76 (9.8)	31 (9.8)	
Widowed	457 (41.9)	298 (38.5)	159 (50.0)	
Domicile (n, (%))				0.001
Alone in private household	473 (43.3)	321 (41.5)	152 (47.8)	
Living together with partner	510 (46.7)	384 (49.6)	126 (39.6)	
Living with relatives/others	46 (4.2)	35 (4.5)	11 (3.5)	
Living in institutions	63 (5.8)	34 (4.4)	29 (9.1)	
GDS (Mean (SD))				< 0.001
Cut-off 4	2.9 (2.8)	1.6 (1.5)	5.5 (2.9)	
IADL (n (%))				< 0.001
Yes (impaired)	678 (62.1)	424 (54.8)	254 (79.9)	
No (unimpaired)	414 (37.9)	350 (45.2)	64 (20.1)	
Care by relatives (n, (%))				< 0.001
Yes	65 (6.0)	23 (3.0)	42 (13.2)	
No	1027 (94.0)	751 (97.0)	276 (86.8)	

Notes. SD = Standard deviation; ¹comparison of depressive and non-depressive patients are based on Pearson chi-square-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; GDS = Geriatric Depression Scale; IADL = Instrumental Activities of Daily Living. Bold values represent statistically significant results at $\alpha < 0.05$.

2.4.1. Latent class analysis

Latent class analysis (LCA) was used to model responses of patients with a particular combination of no, met and unmet needs into different latent subpopulations (classes). Consistent with the objective of this study, the inclusion of CANE items into the LCA was tied to the most frequently reported unmet needs, starting with 15 items with each with $\geq 1\%$ of unmet needs across all needs. Simulation studies suggest that including at least 5 indicator variables improves the class assignment accuracy as well as model convergence rates for sufficiently large sample sizes, as provided here (Masyn, 2013; Wurpts and Geiser, 2014; Lubke and Luningham, 2017). Items with $<1.7\%$ of unmet needs had to be excluded, resulting in the inclusion of the following 11 need items: physical health, eyesight/hearing/communication, mobility/falls, continence, psychological distress, company, intimate relationships, daytime activities, information, looking after home, and benefits (financial assistance).

First, an exploratory class enumeration process was conducted, starting with a 1-class model. To determine the optimal number of classes, additional models were run with up to 5 classes. Multiple sets of random starting values were applied for each k-class to avoid local maxima (Masyn, 2013). Based on criteria of model fit, classification accuracy, parsimony and interpretability, the final k-class model was selected (Nylund et al., 2007). Model fit was assessed using the Bayesian Information Criterion (BIC), with lower values indicating a better fit. In addition, the entropy score informs about the classification accuracy, with values >0.80 indicating good class distinction and accurate classification of individuals into the classes (Clark and Muthén, 2009). Based on the final model, participants were assigned to a class according to their posterior class membership probabilities. Following Janssen et al. (2020), item response probabilities were classified as high (70–100 %), moderate (40–69 %), and low ($<40\%$). Class differences in socio-demographic and clinical characteristics were tested using descriptive statistics and chi-square-tests or Kruskal-Wallis test, as appropriate.

2.4.2. Logistic regression analysis

A stepwise binary logistic regression analysis was conducted to investigate the relationship between the estimated need profiles (classes) and depression in the oldest-old. The binary dependent variable (depressive/non-depressive) was created using a GDS cut-off score of 4. Other covariates known to be associated with depression were added sequentially: starting with the need profiles in the first model, socio-demographic characteristics for age, gender, education, marital status, and domicile were included as predictors in the second model. ADL/IADL and care by relatives were inserted in the third and final model. The likelihood-ratio test (LRT) served to compare the model fit of the hierarchical logistic regressions. If not otherwise stated, the significance level was set to $\alpha \leq 0.05$ for all computations.

3. Results

3.1. Characteristics of the study sample

Table 1 describes the total sample and contrasts characteristics of depressive ($n = 318$, 29.1 %) and non-depressive ($n = 774$, 70.9 %) patients. The average age was 80.7 years ($SD = 4.6$). Compared to non-depressive patients, depressive patients were predominantly female, older, less educated, more often widowed, and living alone or in institutions. The prevalence of functional impairment and caregiving by relatives was also significantly higher in patients with depression.

3.2. Latent class analysis

Table 2 presents the five latent class models with their respective goodness-of-fit characteristics. Accordingly, the 3-class model represented the data most accurately: the 3-class model had the lowest BIC value, indicating best model fit. Furthermore, classification accuracy,

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

	LL	df	AIC	BIC	Entropy
1-class model	−7044.245	22	14132.49	14242.40	–
2-class model	−6461.001	45	13012.00	13236.81	0.777
3-class model	−6363.569	68	12863.14	13202.85	0.828
4-class model	−6303.234	87	12780.47	13215.10	0.827
5-class model	6259.679	100	12719.36	13218.94	0.822

Notes. LL = log likelihood; df = degrees of freedom; AIC = Akaike information criterion; BIC = Bayesian Information Criterion. Bold text indicates the preferred model.

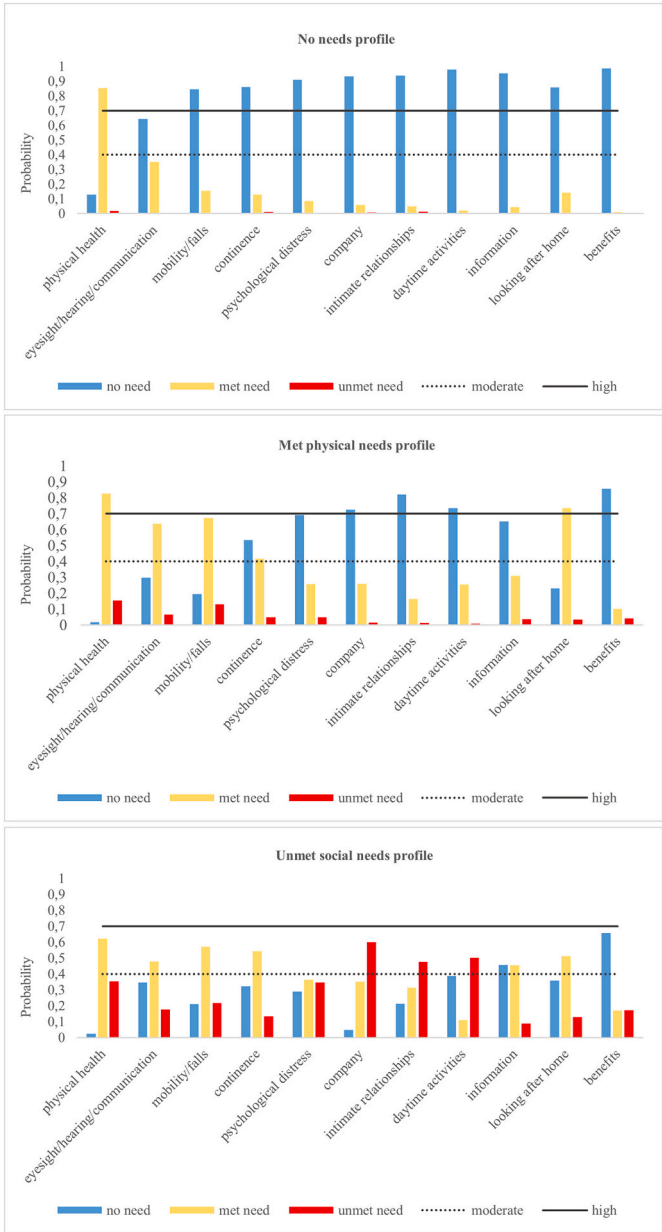


Fig. 2. Item response probabilities of need profiles.

indicated by the entropy score, was highest for the 3-class model at 0.828. In addition, the 3-class model outperformed the other models in terms of parsimony (smallest number of classes with good model fit) and interpretability.

Most patients (64.5 %) were allocated to the so-called ‘no needs’ profile, followed by 31.4 % of patients who fit into the ‘met physical

Table 3

Differences in sociodemographic and clinical characteristics by need profiles.

	No needs profile (n = 704, 64.5 %)	Met physical needs profile (n = 343, 31.4 %)	Unmet social needs profile (n = 45, 4.1 %)	Test statistics ¹
Age (Mean (SD))	80 (4.2)	81.8 (4.9)	81.8 (5.2)	$\chi^2 = 32.6^{***}$
Gender (n, (%))				$\chi^2 = 19.5^{***}$
Male	288 (40.9)	109 (31.8)	6 (13.3)	
Female	416 (59.1)	234 (68.2)	39 (86.7)	
Education ²				$\chi^2 = 18.3^*$
High	153 (21.7)	52 (15.2)	1 (2.2)	
Middle	177 (25.1)	95 (27.7)	9 (20.0)	
Low	374 (53.1)	196 (57.1)	35 (77.8)	
Marital Status (n, (%))				$\chi^2 = 38.9^{***}$
Married/with spouse	372 (52.8)	123 (35.9)	11 (24.4)	
Married/living apart	10 (1.4)	10 (2.9)	2 (4.4)	
Single/Divorced	60 (8.5)	43 (12.5)	2 (8.9)	
Widowed	262 (37.2)	167 (48.7)	28 (62.2)	
Domicile (n, (%))				$\chi^2 = 44.4^{***}$
Alone in private household	276 (39.2)	167 (48.7)	30 (66.7)	
Living together with partner	375 (53.3)	124 (36.2)	11 (24.4)	
Living with relatives/others	24 (3.4)	20 (5.8)	2 (4.4)	
Living in institutions	29 (4.1)	32 (9.3)	2 (4.4)	
GDS (Mean (SD))				$\chi^2 = 175.9^{***}$
Depressive (≥ 4)	116 (16.5)	165 (48.1)	37 (82.2)	
Non-Depressive (<4)	588 (83.5)	178 (51.9)	8 (17.8)	
IADL (n (%))				$\chi^2 = 213.4^{***}$
Yes (impaired)	325 (46.2)	312 (91.0)	41 (91.1)	
No (unimpaired)	379 (53.8)	31 (9.0)	4 (8.9)	
Care by relatives (n, (%))				$\chi^2 = 78.3^{***}$
Yes	9 (1.3)	48 (14.0)	8 (17.8)	
No	695 (98.7)	295 (86.0)	37 (82.2)	

Notes. SD = Standard deviation; ¹comparison of depressive and non-depressive patients are based on Pearson chi-square-tests or Kruskal-Wallis test, as appropriate; ²educational classification according to the new CASMIN educational classification (4). 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; GDS = Geriatric Depression Scale; IADL = Instrumental Activities of Daily Living.

* $p < 0.01$.*** $p < 0.0001$.

needs' profile. The remaining patients (4.1 %) were part of the 'unmet social needs' profile.

As shown in Fig. 2, members in all profiles were comparatively likely to have their physical health needs met and to have no need for benefits. However, there were significant differences between profiles: Members of the 'no needs' profile had a high likelihood of indicating no need for any CANE item. In comparison, members of the 'met physical needs' profile had a moderate to high likelihood of having multiple needs met in the physical needs domain, including physical health, eyesight/hearing/communication, mobility/falls, and continence. Needs related to looking after home were also highly likely to be met. The most striking feature of the 'unmet social needs' profile was the increased probability of unmet needs: members were moderately likely to report a range of unmet social needs, including company, intimate relationships, and daytime activities. Moreover, physical needs were moderately likely to be met, although this profile characteristic was less pronounced than for the 'met physical needs' profile. They were also moderately likely to indicate either no needs or met needs for information and met needs related to looking after home.

3.3. Sociodemographic and clinical characteristics by need profiles

Significant differences with respect to all included sociodemographic and clinical characteristics were found between the need profiles (Table 3). Comparison of the profiles showed that the proportion of patients who are female, less educated, more often widowed and living alone was highest among members of the 'unmet social needs' profile. Moreover, this profile showed the highest proportion of depressed patients. Functional impairments were overrepresented in both the 'met physical needs' and 'unmet social needs' profiles. The rate of caregiving by relatives was also highest among members of the 'unmet social needs'

profile. In contrast, members of the 'no needs' profile were younger, more highly educated, often married and living with their partner. Most members were not depressed, less likely to be functionally impaired and did not need to be cared by a relative.

3.4. The need profiles in the prediction of depression

To analyze the relationship between need profiles and depression, a stepwise binary logistic regression analysis was performed, taking all covariates into account. Results are presented in Table 4. Participants of the met physical and the unmet social needs profile were significantly more likely to have depression: the odds of reporting depressive symptoms was 23.4 times higher for members of the unmet social needs profile and 4.7 times higher for members of the met physical needs profile than for members of the no needs profile (Model 1). In Model 2, sociodemographic covariates like age, gender, education, marital status, and domicile were added. Patients who are living in institutions were 1.8 times more likely to suffer from depression than those living in their private household (OR = 1.826, 95 %-CI: 1.007–3.310). Finally, clinical covariates like ADL/IADL and care by relatives were included in Model 3. Both were significantly associated with depression: the odds of being depressed were 1.5 times higher in functionally impaired patients and 2.3 times higher in patients cared for by relatives. However, living in institutions now became only marginally significant in association with depression. Overall, the association between the identified need profiles (classes) with depression was significant even when controlling for all covariates mentioned in Model 2 and 3. Based on the LRT, Model 3 is considered the model that best represents the data.

Table 4
Results of the stepwise binary logistic regression analysis for cross-sectional prediction of depression.

Model-Variables	Model 1			Model 2			Model 3		
	Odds Ratio	p	95 % CI	Odds Ratio	p	95 % CI	Odds Ratio	p	95 % CI
Need Profiles ^a									
Met physical needs	4.699	<0.001	3.514; 6.094	4.621	<0.001	3.414; 6.253	3.532	<0.001	2.530; 4.930
Unmet social needs	23.444	<0.001	10.643; 51.642	22.67	<0.001	10.105; 50.858	17.447	<0.001	7.67; 39.693
Constant	0.197	<0.001							
Age				0.999	0.969	0.966; 1.033	0.993	0.702	0.960; 1.028
Female				1.247	0.204	0.887; 1.754	1.230	0.240	0.871; 1.736
Education ^b									
Middle				1.167	0.370	0.832; 1.638	1.178	0.346	0.838; 1.658
High				0.773	0.237	0.504; 1.184	0.776	0.249	0.503; 1.195
Marital status ^c									
Married/living apart				0.621	0.451	0.180; 2.141	0.728	0.613	0.213; 2.492
Single/Divorced				1.145	0.741	0.513; 2.556	1.204	0.652	0.537; 2.700
Widowed				1.546	0.219	0.772; 3.097	1.516	0.243	0.754; 3.051
Domicile ^d									
Living together with partner				1.445	0.306	0.714; 2.923	1.424	0.328	0.701; 2.892
Living with relatives/others				0.584	0.174	0.270; 1.267	0.513	0.099	0.232; 1.134
Living in institutions				1.826	0.047	1.007; 3.310	1.795	0.055	0.988; 3.262
Constant				0.125	0.150				
IADL ^e							1.559	0.016	1.086; 2.238
Care by relatives ^f							2.290	0.005	1.286; 4.076
Constant							0.161	0.210	
Likelihood-ratio test (LRT)					0.053			<0.001	

Bold values represent statistically significant results at $\alpha < 0.05$.
^a Reference group for need profiles: no need.
^b Reference group for education = low.
^c Reference group for marital status = married/with spouse.
^d Reference group for domicile: private household.
^e IADL = Instrumental Activities of Daily Living (reference group = unimpaired).
^f Reference group = no.

4. Discussion

The main objective of this exploratory study was to identify different profiles of no, met, and unmet needs in oldest-old GP patients with and without depression. A total of 3 distinct need profiles were determined: no needs, met physical needs, and unmet social needs. The majority of patients were classified as belonging to the no needs profile, which was associated with the lowest risk of depression. In contrast, patients assigned to the other two profiles had a significantly higher risk of depression, with members of the unmet social needs profile most likely to suffer from depression. Considering the need profiles, care by relatives and functional impairment has also been found to be significantly associated with depression.

4.1. The unmet social needs profile and associated factors

The profile of unmet social needs is characterized by patients who were most likely to report unmet needs related to company, intimate relationships, and daytime activities. These findings are in line with recent reviews and meta-analytic studies, which indicate that the care needs in the social domain most often go unmet in old patients (Carvacho et al., 2021; Cheraghi et al., 2021). In addition, previous investigations using the same methodological approach as ours identified similar profiles of unmet needs with old patients reporting severe deficits in the social domains of daytime activities and company (Janssen et al., 2020; Sung and Chan, 2022). Nevertheless, the results are not directly comparable because the studies by Janssen et al. (2020) and by Sung and Chan (2022) examined patients with cognitive impairment and dementia and assessed needs from the caregivers' perspective. This study provides new insights and an important basis for expanding the knowledge of need profiles from the perspective of the oldest-old with depressive symptoms. Unexpectedly, the profiles associated with higher risk of depression in our study (both unmet social and met physical needs profile) had low probabilities of reporting unmet needs in the domain of psychological distress. This outcome contrasts with prior

studies suggesting that psychological distress is one of the most common unmet need section in the aging population, especially in depressed patients (Passos et al., 2017; Carvacho et al., 2021). However, this discrepancy could be attributed to diagnostic differences for determining depression and more severe mental health limitations in the respective study samples. For example, the study by [Passos et al. \(2017\)](#) examined the needs of depressed patients aged 65 and above who had a confirmed clinical ICD-10 diagnosis by a psychiatrist and were attached to a department of psychiatry, partly as inpatients. In comparison, one can assume that our sample of GP patients, who were predominantly homebound and had an overall low GDS mean score, were less severely depressed and therefore experienced less psychological distress.

The results of further analyses of the profiles in terms of socio-demographic factors revealed that patients who were older, female, less educated, widowed and living alone were mostly assigned to the profile with the highest probability of unmet needs, the unmet social needs profile. These outcomes may partly be explained by feelings of loneliness: according to a 5-year longitudinal study of the stability and change in loneliness by [Newall et al. \(2014\)](#), patient characteristics such as widowhood and living alone can lead to persistent feelings of loneliness in older people aged 72–100 years. Similarly, older women are more likely to feel lonely than older men ([Chamberlain et al., 2022](#)). Loneliness, in turn, was associated with fewer social contacts and more unmet healthcare needs ([Chamberlain et al., 2023](#)). Here, a more detailed examination of healthcare needs using the CANE could provide comprehensive insight into specific domains of unmet needs in the future. In summary, the above-mentioned sociodemographic factors of the oldest-old may represent vulnerability to unmet social needs, but further research is needed to identify underlying mechanisms, such as loneliness.

4.2. The need profiles in association with depression

As briefly mentioned above, members of the unmet social needs profile in our study were most likely to suffer from depressive symptoms.

This result is consistent with earlier research on the association between unmet needs and depression in the oldest-old. Accordingly, it is well established that an increase in unmet needs predicted depression in old age (Stein et al., 2016; Carvacho et al., 2021; Eimontas et al., 2022). In the current study, the clustered occurrence of multiple unmet social needs was shown to be the strongest risk factor for depressive symptoms. On the one hand, the restrictions of the depressive symptomatology itself may explain these unmet needs: social isolation, avoidance, and inactivity may reduce action-oriented behavior and can inhibit the establishment and maintenance of social relationships (Coyle and Dugan, 2012; Teo et al., 2020). Similarly, the symptoms may discourage individuals from seeking help and prevent them from effectively communicating their needs, increasing the likelihood that needs will go unmet (Magaard et al., 2017).

On the other hand, the GP may face a barrier to correctly identify the needs, because depression in the oldest-old is often accompanied by physical complaints that may mask other needs, such as social needs related to depression (Stein et al., 2016; Kok and Reynolds, 2017; van Damme et al., 2018). The function of physical complaints to mask other needs could explain our finding that members of the met physical needs profile were also more likely to report depressive symptoms than members of the no needs profile. Medical treatments mostly focus on physical needs, which is consistent with our finding that physical needs were most likely to be met in all patients across all profiles. However, there seems to be a particularly high risk that concomitant depression will not be recognized in older patients: a number of physical complaints can be attributed to comorbid physical illnesses, but also to an underlying depressive disorder that becomes increasingly somatic in old age (Wilowska-Chmielewska et al., 2013; Kapfhammer, 2022). Late life depression is often associated with greater somatization and manifests, for example, in hypochondriasis and psychomotor retardation or agitation (George et al., 2020). Apart from that, physical complaints itself may increase the rate of depression: results of a large longitudinal community-based Canadian study by Patten (2001) indicated that over a 2-year period, the risk of developing depression was almost twice as high (4 %) among persons with chronic medical conditions as among persons without chronic medical conditions (2.8 %). Interestingly, the risk for depression was lower at older ages, but the transferability of this association for oldest-old patients is limited by the fact that the study included younger age cohorts with an age range of 15–74 years. In contrast, a recent review examining longitudinal epidemiologic studies including predominantly older population-based cohorts up to 85 years of age showed that the presence of multiple chronic diseases was related to a higher rate of depressive disorders later in life (Triolo et al., 2020). Ultimately, a bidirectional relationship can be assumed between depressive and physical symptoms (Katon, 2011; Triolo et al., 2020). However, this study does not allow for any directional or causal inferences based on the cross-sectional nature of the analyses.

Overall, the findings suggest that especially the consideration of social needs, but also the presence of physical needs are critical aspects to focus on in interventions to treat oldest-old patients with underlying depressive symptoms. A promising and internationally growing development in community-based health care is offered by the concept of social prescribing (Bhatti et al., 2021). This concept involves evidence-based interventions initiated by the GP. Specifically, with this prescription, the GP can refer the patient to so-called link workers if non-medical, health-related social needs were identified. The link worker then matches patients with social activities in the community, depending on their (unmet) needs (Khan and Giurca, 2023). As such, social prescribing takes a holistic and personalized approach that focuses on individual social care needs and, in this respect, can be particularly helpful for the oldest-old who are vulnerable to depression.

Additional risk factors for depression, besides profile membership, were functional impairment (ADL/IADL) and dependence on care from relatives. A number of studies have already shown that depression is related to functional limitations in activities of daily living (Bruce et al.,

1994; Katon, 2011; Hammer-Helmich et al., 2018). As mentioned earlier, depression in old age is often associated with more physical symptoms, which can significantly affect the management of daily activities. In addition, chronic comorbidities exacerbate physical decline and prescribed medications (including psychotropic drugs) can promote falls and unwanted physical side effects, thereby increasing functional impairments (Frankenthal et al., 2014; Kok and Reynolds, 2017). Finally, both functional impairment and caregiving by relatives could be related to depressive symptoms in the way that the affected individuals are highly dependent on external support (Holm and Severinsson, 2013). In line with this, previous research showed that lower levels of autonomy in old age are closely associated with depression (Davison et al., 2012). Nevertheless, the direction and the cause of these effects are underexplored and therefore require further investigation.

4.3. Strengths and limitations

According to our knowledge, this is the first study to examine the individual combinations of

met and/or unmet needs in a large sample of oldest-old GP patients with and without depression using LCA. A key advantage of LCA for this study is that it can capture the complexity of the overlapping needs of the oldest-old, providing a more comprehensive picture of interrelated met and/or unmet needs in different latent groups. This allows for a more detailed insight into the needs of the oldest-old individuals experiencing depressive symptoms, providing a better foundation for individualized and integrative care. In this regard, GPs fulfill an important function in the correct identification and treatment of unmet needs and potential depression in oldest-old patients.

However, the present study also has a number of limitations. Based on the cross-sectional design of this study, no conclusions can be drawn about the causality or the direction of the association of (unmet) need profiles and depressive symptoms in the oldest-old. Therefore, further research with longitudinal data is needed in the future. It should also be noted that our assessment of depressive symptoms using the GDS does not equate to a clinically diagnosed major depression. Our sample included predominantly fit oldest-old GP patients living at home, with an average GDS score that was low even among patients classified as depressed. Therefore, the generalizability of our results with respect to more severe depression in old age is limited. Another limitation regarding the conclusions of our study concerns social desirability bias. Self-report of depressive symptoms may be severely understated in the oldest-old because positive outcomes associated with aging, such as positive affect, can be significantly influenced by age-related increases in socially desirable responses (Soubelet and Salthouse, 2011). In addition, oldest-old patients may be aware of a problem but can be reluctant to disclose it, for example, because of fear of stigmatization, because they attribute their problem to normal aging, or because they do not know where to find help (Dezetter et al., 2015; Yan et al., 2022). The inclusion of multiple perspectives (e.g., GP, caregiver, patient) using the CANE on the needs of the oldest-old could eliminate these biases in future studies. Finally, it should be noted that LCA is sample-specific and the identified need profiles may not be generalizable to other oldest-old GP patients in Germany. To prove external validation, future research should cross-validate our findings in different samples. Further, LCA is a statistical method used to classify subgroups that best fit the data. For clinical implications, we not only considered fit statistics but also the interpretability and meaningfulness of the profiles for our sample within the focus of the research (Sinha et al., 2021).

4.4. Conclusions and future directions

This study provides detailed insight into specific constellations of needs among oldest-old GP patients with depressive symptoms. The combination of multiple unmet social care needs was associated with the highest risk for depression in oldest-old patients. Thus, belonging to the

profile of unmet social needs indicates a potential risk of developing depressive symptoms. Impaired functional status and care by relatives may be indirectly associated with depressive symptoms through lower levels of autonomy.

The identification of risk profiles in depression in the oldest-old form an important basis for the development and improvement of individually tailored interventions. Accordingly, special attention should be paid to the presence of unmet social needs in oldest-old persons, for example, by using new innovative health care approaches such as social prescribing. Establishing social contacts, intimate relationships, and daily activities could significantly reduce the risk for depressive symptoms and thereby improve the quality of life of oldest-old GP patients. Further research of more restricted patient groups in other settings, such as hospitals and nursing homes, is needed for a more nuanced understanding of the need profiles of clinically depressed oldest-old people. Examining multiple perspectives (e.g., GP, caregiver, patient) in future studies to accurately assess needs will be critical for the development of treatment approaches in this context.

CRedit authorship contribution statement

Sophia Kraake: Writing - original draft, Formal analysis, Methodology, Writing - review & editing. **Alexander Pabst:** Methodology, Formal analysis, Validation, Supervision, Writing - review & editing. **Birgitt Wiese:** Conceptualization, Project administration, Data curation, Writing - review & editing. **Lilia Moor:** Data curation, Writing - review & editing. **Hans-Helmut König:** Conceptualization, Project administration, Writing - review & editing. **André Hajek:** Investigation, Writing - review & editing. **Hanna Kaduszkiewicz:** Conceptualization, Project administration, Writing - review & editing. **Martin Scherer:** Conceptualization, Project administration, Writing - review & editing. **Anne Stark:** Investigation, Writing - review & editing. **Michael Wagner:** Conceptualization, Project administration, Writing - review & editing. **Wolfgang Maier:** Conceptualization, Project administration, Writing - review & editing. **Jochen Werle:** Investigation, Writing - review & editing. **Siegfried Weyerer:** Conceptualization, Project administration, Writing - review & editing. **Steffi G. Riedel-Heller:** Conceptualization, Project administration, Methodology, Formal analysis, Validation, Supervision, Writing - review & editing. **Janine Stein:** Conceptualization, Project administration, Methodology, Formal analysis, Validation, Supervision, Writing - review & editing.

Declaration of competing interest

The authors report no conflicts of interest.

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