REVIEW

Residents with mental–physical multimorbidity living in long-term care facilities: prevalence and characteristics. A systematic review

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ABSTRACT

Background: Aging societies will be confronted with increased numbers of long-term care (LTC) residents with multimorbidity of physical and mental disorders other than dementia. Knowledge about the prevalence rates, medical and psychosocial characteristics, and care needs of this particular group of residents is mandatory for providing high-quality and evidence-based care. The purpose of this paper was to review the literature regarding these features.

Methods: A systematic literature search was conducted in PubMed, EMBASE, PsycINFO, and CINAHL from January 1, 1988 to August 16, 2011. Two reviewers independently assessed eligibility of studies on pre-established inclusion criteria as well as methodological quality using standardized checklists.

Results: Seventeen articles were included. Only one small study describes multimorbidity of a wide range of chronic psychiatric and somatic conditions in LTC residents and suggests that physical–mental multimorbidity is rather rule than exception. All other studies show prevalence rates of comorbid physical and mental illnesses (range, 0.5%–64.7%), roughly in line with reported prevalence rates among community-dwelling older people. LTC residents with mental–physical multimorbidity were younger than other LTC residents and had more cognitive impairment, no dementia, and problem behaviors. Care needs of these residents were not described.

Conclusions: Although exact figures are lacking, mental–physical multimorbidity is common in LTC residents. Given the specific characteristics of the pertaining residents, more knowledge of their specific care needs is essential. The first step now should be to perform research on symptoms and behavior, which seem more informative than diagnostic labels as well as care needs of LTC residents with mental–physical multimorbidity.

Key words: long-term care, neuropsychiatric symptoms, medical comorbidity, residential facilities

Introduction

The world's population is aging. Ten-year projections suggest that the annual net increase of the number of people over the age of 65 years will be about 23 million (Kinsella and He, 2009). Because the prevalence of many health problems increases with age, this demographic trend will also lead to a rising prevalence of multimorbidity in the upcoming years and probably also to an increased need for long-term care (LTC) (Schram *et al.*, 2008; Singh, 2010a).

Multimorbidity is defined as the simultaneous occurrence of several medical conditions in the same person (van den Akker *et al.*, 1996). Reported prevalence rates of multimorbidity vary widely across studies, from around 20% to 30% in the general population to 55% to 98% when only older persons were included (Marengoni *et al.*, 2011). The prevalence of multimorbidity in the elderly population is much higher than the prevalence of the most common diseases of the elderly such as

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heart failure and dementia (Marengoni *et al.*, 2008). Still, the number of studies on multimorbidity is much smaller than those on individual chronic diseases (Fortin *et al.*, 2005). Moreover, research on multimorbidity mainly focuses on either somatic or psychiatric multimorbidity. Furthermore, multimorbidity by itself does not predict the need for LTC but its consequences with respect to disability and dependency (Singh, 2010b). Given that psychosocial and mental health problems are strongly associated with a higher level of dependency (Scott *et al.*, 2009), mental–physical multimorbidity requires special attention (Bartels *et al.*, 1999; Mercer *et al.*, 2012). Yet, the few studies that do investigate mental–physical multimorbidity (Nuyen *et al.*, 2006) typically focus on the association between one somatic or one psychiatric index disease and one or a restricted set of comorbid conditions (Gijsen *et al.*, 2001; Angelelli *et al.*, 2004; Frankenburg and Zanarini, 2004; Iacovides and Siamouli, 2008; Reijnders *et al.*, 2008). Undeniably, the clustering of general somatic and psychiatric morbidity is hardly studied (Lobo-Escolar *et al.*, 2008; Andrade *et al.*, 2010), although Lobo-Escolar *et al.* (2008) found it to be prevalent (20%) in elderly people over 55 years of age living in the community. LTC facilities will accommodate an even higher proportion of individuals with comorbid mental and physical illnesses compared to the community (Bartels *et al.*, 1999).

In order to improve the cost-effectiveness of mental health care, a trend has been observed to reduce the number of psychiatric hospital beds for both short-stay and long-stay wards in many Western countries (Novella, 2010). Consequently, the traditional asylum function of psychiatric hospitals for older adults with severe mental illness who require assistance with physical health care is largely taken over by nursing homes (Bartels *et al.*, 2003).

Between 60% and 90% of nursing home residents have a mental condition, including dementia (Bartels *et al.*, 2002; Li, 2010; Seitz *et al.*, 2010). A recent systematic review reported a median prevalence rate of 58% for dementia, 10% for major depressive disorder, and 29% for depressive symptoms (Seitz *et al.*, 2010). Data on other psychiatric disorders are scarce but suggest relatively high prevalence rates of anxiety problems (range, 3.5% for anxiety or panic disorder to 29.7% for clinically relevant anxiety symptoms), substance use disorders (SUDs) (range, 0.9%–18%), schizophrenia (range, 5.9%–9.8%), and bipolar disorder (3%).

Two recent studies in the United States using three different data sources (Bagchi *et al.*, 2009;

Fullerton *et al.*, 2009) concluded that the prevalence rate of a primary diagnosis of mental illness excluding dementia in nursing home residents varied from 4.4% in Medicaid claims to 7% in the National Nursing Home Survey (NNHS). Taking secondary mental illness diagnoses into account, prevalence rates increased to 7% in Medicaid claims, 33.1% in the NNHS, and 46% in the Minimum Data Set (MDS (Morris *et al.*, 1990)) of the Resident Assessment Instrument (Bagchi *et al.*, 2009). Using a sample of all "first-time" nursing home admissions from the MDS in 2005, Fullerton *et al.* (2009) found that 24% had a mental illness as defined by schizophrenia, bipolar disorder, depression, or anxiety disorder.

The interpretation of the above-mentioned prevalence rates and consequences for LTC health care planning depends on the relative importance of three components within a society, that is, (1) the informal system, (2) the community-based system, and (3) the institutional system (Singh, 2010b). In other words, from which component a patient will receive LTC depends not only on his level of functioning and the complexity of the services he or she needs but also on a host of sociocultural factors, such as the structure and organization of the health care system, the health insurance system by both the government and the private sector, the availability and type of housing, the structure of families, and the preferences of elderly people and their caregivers (Ribbe *et al.*, 1997). Nevertheless, potential decisions on these components should be driven by prevalence as well as care needs of this patient group.

In order to disentangle some of this heterogeneity, we aimed to perform a systematic review on the mental–physical multimorbidity of residents in LTC facilities.

The specific aims of the present literature review are to study

1. the prevalence of mental–physical multimorbidity in middle-aged and elderly LTC residents without dementia,
2. the characteristics and care needs of these residents, and
3. the determinants of mental disorders in physical disorders or vice versa.

Methods

Identification of relevant literature

A systematic search was conducted in PubMed, EMBASE, PsycINFO, and CINAHL in order to identify literature on the mental–physical multimorbidity of residents in LTC facilities. MeSH terms (Pubmed), Thesaurus terms (EMBASE,

PsycINFO, CINAHL) and free text words were used for the search. These terms included ("residential facilities" or "assisted living facilities" or "group homes" or "homes for the aged" or "nursing homes" or "long-term care facilit*" or "supervised residential setting*" or "residential aged care facilit*" or "elderly care facilit*") combined with ("comorbidity" or "multimorbidity") or (("mental*" or "psychiatr*") and ("somatic*" or "physical*" or "general medical")). Articles with the key words "dementia," "mental retardation," or "acute" were excluded from the search. Furthermore, the search was limited to residents in the age of 45 years and older and to English and Dutch publications from January 1, 1988 to August 16, 2011. The start date for the search was chosen because of the policy changes in the LTC in the United States by the introduction of the Omnibus Reconciliation Act of 1987 (OBRA 87). In addition, a search of the listed references in the reviewed papers was performed.

Selection of the literature

The first author (AvdB) screened all titles and abstracts on their potential to meet the inclusion criteria as described below. The second author (DG) checked all references published in the years 2009 to 2011 on the same potential. As the results were fully consistent with the results of the first author, titles and abstracts published before 2009 were screened by the first author only. Full text of the references remaining after the first screening was studied on the inclusion criteria by both authors. Disagreements were discussed until consensus was reached. Finally, the reference list of included articles was manually screened to identify any relevant references that had not yet been included.

Studies were included in the review if they

1. included original data on LTC residents aged 45 years and older,
2. comprised a substantive description of both chronic medical and psychiatric problems (not dementia or mental retardation), and
3. contained at least one of the following outcomes:
   - prevalence rates of mental–physical comorbidity,
   - characteristics and/or care needs of LTC residents with mental–physical comorbidity, and
   - determinants of mental disorders in physical disorders or vice versa.

In order to determine whether mental–physical multimorbidity was investigated, a description of specific mental and physical diseases in the studies was a prerequisite. Studies in which multimorbidity was only numerically measured (for instance, with the Charlson Comorbidity Index or the Cumulative Illness Rating Scale) were excluded.

Data extraction

Information was collected on country and year of publication, study design, setting, sample size, mean age of patient population, method and period of data gathering, and statistical analysis (Tables 1–3). For the purpose of this review, data about prevalence of mental–physical comorbidity (Tables 4 and 5) and associations between mental and physical conditions (Table 3) were included in the results tables. Data were extracted by one author (AvdB) and reviewed by the other authors.

Appraisal of the methodological quality

Gold standards to evaluate internal and external validity of observational research do not exist (Sanderson *et al.*, 2007). For the appraisal of the selected studies, two checklists with criteria for methodological quality were used.

Prevalence studies were rated using the criteria adapted by Pitfield *et al.* from Boyle's guidelines (Boyle, 1998; Pitfield *et al.*, 2011). Each paper was rated, with up to one point being given if a criterion was fulfilled and a total score was calculated (Appendix 1).

The same method was used for the non-prevalence studies, applying a checklist for etiological research as described by Van der Windt *et al.* (2000) (Appendix 2).

Two authors (AvdB and DG) rated the studies blind to each other's assessments. Disagreement between reviewers was resolved by discussion.

Results

Identification and selection of the literature

The electronic search generated a list of 1,747 references. All references were imported into a bibliographic management software program to detect duplicates.

After removing duplicates, a list of 1,236 references remained. From this list, 1,170 references were excluded because title and abstract made clear that, without any doubt, the articles did not meet one or more of the inclusion criteria. The vast majority of the articles that have been excluded had other outcomes than those described in the inclusion criteria.

The initial screening resulted in a list of 66 references of which the full texts were studied. Regarding 7 articles (11%) either the first or the second author was in doubt about the

Table 1. Characteristics of included prevalence studies based on national databases

REFERENCE	DESIGN	SETTING AND SAMPLE	METHODS AND PERIOD OF DATA GATHERING	METHODS OF DATA ANALYSIS	QUALITY SCORE (0–8)
#1. Aschbrenner *et al.* (2011), USA	Retrospective cohort study	Nursing homes Mean age: SMI <65: 51.12 (SD = 9.81) SMI >65: 75.50 (SD = 7.24) Non-SMI <65: 54.33 (SD = 8.85) Non-SMI >65: 80.94 (SD = 7.74) N = 1,094,560	Using data from the national nursing home MDS clinical and functional assessment; 2005	Descriptive statistics; comparison of proportions	7.5
#2. Lemke and Schaefer (2010), USA	Cross-sectional study	VA Nursing homes Mean age: SUD: 70.0 (SD = 8.5) Non-SUD: 75.1 (SD = 8.2) N = 27,002	Using data from the VA National Patient Care Database; Patient Assessment Instrument October 1999 to September 2000	Descriptive statistics; χ^2 analyses; *t*-tests; Bonferroni correction; Logistic regression analyses	6.5
#3. Fullerton *et al.* (2009), USA	Longitudinal study (dynamic population) and cross-sectional study	Nursing homes Mean age: 80.9 N = 7,364,470 (longitudinal study) N = 996,311 (cross-sectional study)	Using data from the national nursing home MDS resident assessment instrument 1999–2005 (longitudinal) 2005 (cross-sectional)	Descriptive statistics; χ^2 test	7.5
#4. Travis *et al.* (2004), USA	Cross-sectional study	Nursing homes Mean age: 72.8 (SD = 13.6) N = 548,572	Using data from the national nursing home MDS 2002	Descriptive statistics, using the statistical software package SAS	7.5
#5. Buchanan *et al.* (2003), USA	Cross-sectional study	Nursing homes Mean age: MS+D: 55.9 (SD = 13.6) MS-D: 58.4 (SD = 14.0) N = 14,009	Using data from the national nursing home MDS 23 June 1998–31 December 2000	Descriptive statistics, using the statistical software package SAS; Two sample tests for comparisons of proportion and for continuous variables were used; Two-way contingency table χ^2 test	3.5
#6. Buchanan *et al.* (2002), USA	Cross-sectional study	Nursing homes Mean age: HIV+D: 48.0 (SD = 15.1) HIV-D: 45.9 (SD = 11.4) N = 5114	Using data from the national nursing home MDS 23 June 1998–31 December 2000	Descriptive statistics, using the statistical software package SAS; Two sample tests for comparisons of proportion and for continuous variables were used; Two-way contingency table χ^2 test	3.5

SMI = serious mental illness; MDS = Minimum Data Set; SUD = substance use disorder; SAS = Statistical Analysis Software.

Table 2. Characteristics of included prevalence studies in selected subpopulations

REFERENCE	DESIGN	SETTING AND SAMPLE	METHODS AND PERIOD OF DATA GATHERING	METHODS OF DATA ANALYSIS	QUALITY SCORE (0–8)
#7. Akner (2009), Sweden	Cross-sectional study	Nursing homes Mean age: 85.0 (SD = 7.0) N = 70 NH residents in stable clinical condition	Clinical examination (history and physical examination); mini-mental state examination, Katz score; review of the medical records; serum chemical analysis (serum creatinine) 2001–2002	Descriptive statistics using the statistical software package SAS; *t* test	2.5
#8. Placentino *et al.* (2009), Italy	Cross-sectional study	Residential facilities Mean age: 47.7 (SD = 14.7) N = 426 psychiatric patients	Structured clinical Interview for DSM-IV, Brief Psychiatric Rating Scale, Global Assessment of Functioning Scale, Disability Assessment Schedule; review of the medical records, physical examination, blood, and serum chemical analyses, ECG 22 months	Descriptive statistics using the statistical software package SPSS; one-way ANOVA; Bonferroni test; Pearson and Spearman correlations	2.5
#9. de Girolamo *et al.* (2005), Italy	Cross-sectional study	Residential facilities Mean age: Males: 48.6 Females: 50.9 N = 2962 severely mentally ill patients	Standardized interviews; review of the medical records; The Health of Nation Outcome Scale, the Global Assessment of Functioning, the Physical Health Index Unknown	Descriptive statistics, using the statistical software package SPSS; χ^2 test with Yates' correction; *t* tests; one-way ANOVA; Bonferroni method; multiple logistic regression analysis.	4.5
#10. Schepers *et al.* (2000), the Netherlands	Case series	Nursing homes Mean age: 53 (SD = 8,9) N = 77 patients with Korsakoff's syndrome	Review of the medical records 01-01-1984–01-01-1998	Descriptive statistics, using the statistical software package SPSS; Kaplan–Meier method	2.5
#11. Trilling *et al.* (1998), USA	Cross-sectional study	Nursing homes N = 804	Review of the medical records Unknown	Descriptive statistics; Pearson χ^2 statistic	2.5
#12. Mukherjee *et al.* (1996), Italy	Cross-sectional study	Long-term care facility Mean age: Sch + DM: 62.4 (SD = 5.5) Sch − DM: 60.7 (SD = 7.4) N = 95 patients with schizophrenia	Review of the medical records Unknown	Descriptive statistics; χ^2 test Mann–Witney *U* test	2.5

NH = nursing home; ECG= electrocardiogram; ANOVA = analysis of variance; Sch = schizophrenia; DM = diabetes mellitus.

Table 3. Characteristics of included other observational studies

REFERENCE	DESIGN	SETTING AND SAMPLE	METHODS AND PERIOD OF DATA GATHERING	METHODS OF DATA ANALYSIS	QUALITY SCORE (0–8)	MAIN RESULTS
#13. Barca *et al.* (2009), Norway	Cross-sectional study	Nursing homes Age: <80: N = 167 80–84: N = 234 85–89: N = 246 >89: N = 255 N = 902	Neuropsychiatric Inventory nursing home version, Cornell Scale for Depression in Dementia, Clinical Dementia Rating scale, Physical Self-Maintenance scale; review of the medical records November 2004 to January 2005	Univariate analyses using the statistical software package SPSS; Spearman's ρ; Mann–Whitney U test; Kruskal Wallis test; Linear regression analyses	5.5	In the adjusted analysis, depression according to the Cornell total score was associated with worse medical health (strongest) and worse cognitive impairment but not with worse functional impairment. The mood subscale score was associated with worse medical health (strongest), pulmonary diseases, being unmarried and female gender, but not with worse cognitive impairment. The non-mood subscale score was correlated with cognitive impairment (strongest), worse medical health, younger age, digestive diseases, and not having suffered from stroke.
#14. Jang *et al.* (2007), USA	Cross-sectional study (survey)	Assisted living facilities Mean age: 82.8 (SD = 9.41) N = 150	Structured questionnaire, including the Geriatric Depression Scale (15 items), 5 items from the SF-36, a checklist of comorbid medical conditions, a 17 items composite measure to assess functional status, and control variables (age, gender, marital status, and cognition (Short Portable Mental Status Questionnaire)) Summer 2004	Descriptive statistics; bivariate correlations; multivariate analyses (collinearity diagnostics were conducted with the Variance Inflation Factor); regression analyses; Sobel test	4	In bivariate analysis, both chronic conditions and functional disability were positively associated with depressive symptoms. In a multivariate model, only functional disability was identified as a significant risk factor for depressive symptoms. But the analyses showed that the initially significant associations between health-related variables and depressive symptoms either became non-significant or decreased when health perceptions were controlled.

Table 3. Continued

REFERENCE	DESIGN	SETTING AND SAMPLE	METHODS AND PERIOD OF DATA GATHERING	METHODS OF DATA ANALYSIS	QUALITY SCORE (0–8)	MAIN RESULTS
#15. Jang *et al.* (2006), USA	Cross-sectional study (survey)	Assisted living facilities Mean age: 82.8 (SD = 9.41) N = 150	Structured questionnaire, including the Geriatric Depression Scale (15 items), 5 items from the SF-36, a checklist of comorbid medical conditions, a 17 items composite measure to assess functional status, and control variables (age, gender, marital status, and cognition (Short Portable Mental Status Questionnaire)) Summer 2004	Descriptive statistics; bivariate correlations; hierarchical regression analyses	4	Higher levels of depressive symptoms were observed among older residents with greater level of functional disability, poorer self-rated health, lower sense of mastery, less religiosity, and less positive attitude toward aging. In addition, the linkages between physical and mental health were modified by psychosocial resources. For older residents with more positive beliefs and attitudes (a higher sense of mastery, greater religiosity, and more positive attitudes toward aging), the adverse effects of functional disability or poorer self-rated health on depressive symptoms were attenuated. Psychosocial resources have a protective role against physical health constraints.
#16. Jongenelis *et al.* (2004), the Netherlands	Cross-sectional study	Nursing homes Mean age: 79.4 (SD = 8.3) N = 333	Face-to-face interview, including the Geriatric Depression Scale, the Schedule of Clinical Assessment in Neuropsychiatry, the Mini-Mental State Examination, Nottingham Health Profile (items concerning pain), Sickness Impact Profile (items concerning ADL), Loneliness Scale, Social Support List Interaction version, the Dutch Quality of Life scale. November 1999 to May 2001	Descriptive statistics; bivariate analysis; calculation of the odds ratios, with their 95% confidence interval; stepwise multivariate logistic regression analysis	4.5	Significant risk indicators for major depression: pain, functional limitations, visual impairment, stroke, loneliness, lack of social support, negative life events, and perceived inadequacy of care. For subclinical depression, the same risk indicators were found, with the exception of lack of social support.

Table 3. Continued

REFERENCE	DESIGN	SETTING AND SAMPLE	METHODS AND PERIOD OF DATA GATHERING	METHODS OF DATA ANALYSIS	QUALITY SCORE (0–8)	MAIN RESULTS
#17. Cuijpers and Van Lammeren (1999), the Netherlands	Cross-sectional study	Residential facilities Mean age: 84.5 N = 424	Pre-test data from an intervention study; information from the staff (interview); Mini-Mental State Examination, Geriatric Depression Scale, the Medical Outcomes Study Short Form-20 (mental health subscale and pain subscale), seven items measuring limitations in instrumental activities of daily living, Questionnaire Recent Life Events, Social Support List Interaction version Unknown	Descriptive statistics; *t* tests; ANOVA; linear multiple regression analyses	4.5	In the analysis of variance, the level of depressive symptoms did not differ significantly for the illnesses investigated in this study (lung disease, cardiac disease, peripheral artherosclerosis, diabetes mellitus, stroke, rheumatoid arthritis, cancer). This study found strong support for the significance of other risk factors for depression: earlier depression, life events, lack of social support, pain, and functional impairment. Possibly, the absence of a strong link between depressive symptomatology and chronic illness was because inhabitants of residential homes all had major physical, psychological, or social limitations, which prevented them from living independently. If impairment was considerable and people could not live independently, then it could be hypothesized that the illness did not add very much to the risk of getting depressed, so other risk factors may become more important in this context.

ADL = activities of daily living; ANOVA = analysis of variance.

Table 4. Results of included prevalence studies based on national databases

#1. ASCHBRENNER	#2. LEMKE	#3. FULLERTON	#4. TRAVIS	#5. BUCHANAN	#6. BUCHANAN
SMI <65 (N = 13,730)	SUD (N = 4,849)	Schizophrenia (N = 5,404)	Diabetes	MS + depression	HIV + depression
+ Diabetes: 29.90%)	+ Diabetes: 31.1%	+ Diabetes: 31.5%	(N = 144,969)	(36% of N = 14,009)	(20.7% of N = 5114)
+ Obesity: 40.96%	+ CHF: 26.7%	+ Endocrine, excluding diabetes: 10.6%	+ depression: 30%	+ Verbally abusive: 7.5%	+ Delusions: 11.0%
+ CHF: 7.30%	+ Cerebrovascular disease: 35.4%	+ Cardiovascular: 55.5%	Non-diabetes	+ Socially disruptive behavior:	+ Hallucinations: 9.8%
+ AHD: 3.30%	+ Neurological disorders: 21.2%	+ Musculoskeletal: 22.0%	(N = 403,603)	7.4%	+ Anxiety disorder: 20.0%
+ Stroke: 6.43%	+ COPD: 55.0%	+ Neurological, excluding dementia: 11.2%	+ depression : 27.5%	+ Resists care: 13.3%	HIV without depression:
+ PD: 1.66%	+ Gastrointestinal disorders: 64.7%	+ Pulmonary: 26.0%		+ Delusions: 4.9%	(79.3% of N = 5114)
+ COPD: 18.00%	+ Renal failure/nephritis: 14.7%	+ Sensory: 5.2%		+ Hallucinations: 4.6%	+ Delusions: 1.9%
SMI > 65 (N = 13,913)	+ AIDS/HIV/hepatitis: 7.2%	+ Other: 29.3%		+ Anxiety disorder: 15.8%	+ Hallucinations: 1.4%
+ Diabetes: 28.48%	+ Skin/subcutaneous infection: 23.2%	Bipolar disorder (N = 5,299)		MS without depression:	+ Anxiety disorder: 2.9%
+ Obesity: 24.70%	+ SMI: 30.2%	+ Diabetes: 28.0%		(64% of N = 14,009)	
+ CHF: 13.81%	+ Depressive disorders: 43.6%	+ Endocrine, excluding diabetes: 15.9%		+ Verbally abusive: 4.6%	
+ AHD: 9.19%	+ PTSD: 10.8%	+ Cardiovascular: 56.1%		+ Socially disruptive behavior:	
+ Stroke: 10.29%	+ Verbal disruption: 7.5%	+ Musculoskeletal: 26.4%		5.0%	
+ PD: 5.92%	+ Injury: 55.3%	+ Neurological, excluding dementia: 10.3%		+ Resists care: 9.1%	
+ COPD: 21.98%	Non-SUD (N = 22,153)	+ Pulmonary: 25.5%		+ Delusions: 1.1%	
Non-SMI < 65	+ Diabetes: 41.2%	+ Sensory: 5.2%		+ Hallucinations: 0.8%	
(N = 110,050)	+ CHF: 34.0%	+ Other: 32.4%		+ Anxiety disorder: 3.6%	
+ Diabetes: 37.72%	+ Cerebrovascular disease: 41.2%	Depression (N = 154,262)			
+ Obesity: 38.66%	+ Neurological disorders: 26.3%	+ Diabetes: 30.3%			
+ CHF: 11.58%	+ COPD: 41.4%	+ Endocrine, excluding diabetes: 12.1%			
+ AHD: 6.33%	+ Gastro-intestinal disorders: 53.1%	+ Cardiovascular: 64.3%			
+ Stroke: 14.08%	+ Renal failure/nephritis: 17.9%	+ Musculoskeletal: 30.6%			
+ PD: 0.94%	+ AIDS/HIV/hepatitis: 2.1%	+ Neurological, excluding dementia: 15.6%			
+ COPD: 15.57%	+ Skin/subcutaneous infection: 25.8%	+ Pulmonary: 25.2%			
Non-SMI > 65	+ SMI: 19.1%	+ Sensory: 7.3%			
(N = 956,867)	+ Depressive disorders: 31.7%	+ Other: 34.4%			
+ Diabetes: 27.26%	+ PTSD: 5.0%	Anxiety disorder (N = 22,513)			
+ Obesity: 20.67%	+ Verbal disruption: 6.2%	+ Diabetes: 24.9%			
+ CHF: 19.71%	+ Injury: 44.3%	+ Endocrine, excluding diabetes: 18.8%			
+ AHD: 12.01%		+ Cardiovascular: 84.9%			
+ Stroke: 13.15%		+ Musculoskeletal: 48.1%			
+ PD: 2.54%		+ Neurological, excluding dementia: 11.2%			
+ COPD: 17.87%		+ Pulmonary: 31.6%			
		+ Sensory: 12.7%			
		+ Other: 60.3%			
		Neither mental illness nor dementia (N = 625,874)			
		+ Diabetes: 28.4%			
		+ Endocrine, excluding diabetes: 8.2%			
		+ Cardiovascular: 58.7%			
		+ Musculoskeletal: 26.4%			
		+ Neurological, excluding dementia: 13.2%			
		+ Pulmonary: 19.9%			
		+ Sensory: 5.9%			
		+ Other: 28.1%			

SMI = serious mental illness; SUD = substance use disorder; CHF = congestive heart failure; AHD = arteriosclerotic heart disease; PD = Parkinson's disease; COPD = chronic obstructive pulmonary disease; PTSD = post-traumatic stress disorder; MS = multiple sclerosis; HIV = human immunodeficiency virus.

Table 5. Results of included prevalence studies on selected subpopulations

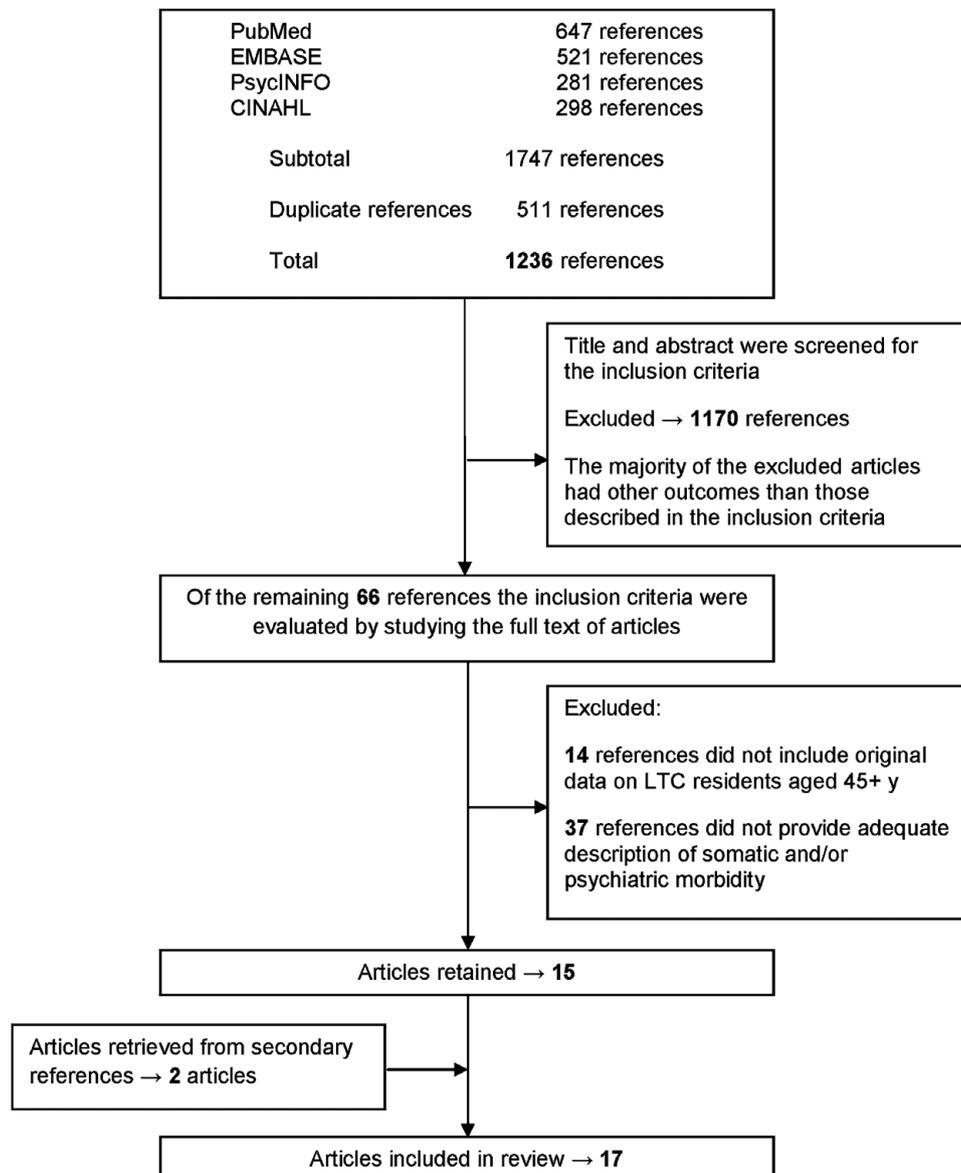| #7. AKNER	#8. PLACENTINO	#9. DE GIROLAMO	#10. SCHEPERS	#11. TRILLING	#12. MUKHERJEE
A total of 275 separate chronic health problems were identified.	Primary (psychiatric) diagnosis: Schizophrenia/psychotic disorders: 41,8%	Primary (psychiatric) diagnosis: Schizophrenic disorders: 68.2%	Comorbidity at admission: Neurological: 52/77	Hypertension: + Psychosis: 4.5%	Schizophrenia + diabetes: 15,8%
Average number of different health problems: 16.8 (SD = 5.3, range, 6–33).	Affective disorders: 35.4%	Bipolar disorders: 4.1%	Gastrointestinal: 25/77	+ Depression: 23.9%	<50 y: 0%
Most frequent (>50%):	Personality disorders: 14.1%	Personality disorders: 8.5%	Cardiovascular: 20/77	+ Other mental disease: 8.2%	50–59 y: 12.9%
Neuropsychiatric: 100%	Substance use disorders: 3.5%	Mental retardation and organic brain disorders (including dementia): 13.1%	Skeleton–muscular: 17/77	Normotension:	60–69 y: 18.9%
Cognitive impairment: 66%	Mental disability: 3.1%	Substance or alcohol abuse: 0.8%	Psychiatric: 15/77	+ Psychosis: 1.8%	70–74 y: 16.7%
Brain ischemia: 53%	Obsessive–compulsive disorders: 2.1%	Other disorders (e.g., unipolar depression, anxiety disorders, eating disorders, other psychiatric disorders): 6.7%	Skin: 10/77	+ Depression: 14.0%	
Sleeping problems: 46%	Psychiatric comorbidity: 33.3%.	Moderate and severe physical disabilities:	Respiratory: 9/77	+ Other mental disease: 4.5%	
Depression: 39%	Personality disorders: 42.9%	Cardiovascular: 7.5%	Chronic disorders diagnosed during admission:		
Anxiety disorders: 39%	Substance use disorders: 39.4%	Respiratory: 5.2%	Psychiatric: 21/77		
Psychotic state: 26%	Affective disorders: 8.5%	Digestive: 5.0%	Cardiovascular: 15/77		
Cardiovascular: 78%	Anxiety disorders: 7.1%	Urogenital: 4.5%	Neurological: 13/77		
Gastrointestinal: 86%	Eating disorders: 2.1%	Motor: 8.0%	Gastrointestinal: 9/77		
Renal–urinary: 86%	Comorbid physical conditions:	Central nervous system: 5.9%	Endocrine: 8/77		
Endocrine–metabolism: 54%	Cardiovascular: 30%	Endocrine–metabolic: 7.1%			
Skeleton: 60%	Endocrine–nutrition–metabolic: 28.5%	Infective (including HIV+): 1.9%			
Pain: 73%	Gastrointestinal: 18.4%				
	Respiratory: 7.5%				
	Neurological: 7%				
	Hematologic: 2.2%				
	Physical injury: 1.8%				
	Sensory disorders: 1.5%				
	Immune disorders: 1%				
	Renal–urinary: 0.9%				
	Neoplasm: 0.7%				
	Psoriasis: 0.5%				

Figure 1. Flowchart of the articles involved in this systematic review.

need to exclude the article. After consensus discussion, 51 articles were excluded because of failure to meet one or more inclusion criteria. Although both publications of Buchanan *et al.* (2002; 2003) were conducted on the same source population, they were not considered duplicates as analyses were performed on two different subsamples (patients with multiple sclerosis (MS) and with human immunodeficiency virus (HIV), respectively). Comparably, Jang *et al.* (2006; 2007) examined different sets of determinants of the association between depression and physical illness within the same study population, without duplication of quantitative data.

Two articles were retrieved from secondary references. Finally, 17 articles were retained for analysis in this review (flowchart: see Figure 1).

Twelve prevalence studies were identified. Six of those were based on national nursing home databases in the United States (Buchanan *et al.*, 2002; 2003; Travis *et al.*, 2004; Fullerton *et al.*, 2009; Lemke and Schaefer, 2010; Aschbrenner *et al.*, 2011). Six describe prevalence rates in selected subpopulations: three in residential facilities in Italy (Mukherjee *et al.*, 1996; de Girolamo *et al.*, 2005; Placentino *et al.*, 2009), one in a nursing home in Sweden (Akner, 2009), one in a nursing home in the United States (Trilling *et al.*, 1998), and one in a Dutch nursing home (Schepers *et al.*, 2000). Furthermore, five observational studies were included: one in Norwegian nursing homes (Barca *et al.*, 2009), two in assisted living facilities in the United States (Jang *et al.*, 2006; 2007), and two in Dutch nursing homes (Cuijpers

and Van Lammeren, 1999; Jongenelis *et al.*, 2004).

Methodological quality

The percentage of agreement between the first and the second author in the scores on the checklists was 83.4%; regarding the score on 24 input fields discussion was needed to achieve consensus.

As shown in Appendix 1 (sum scores are displayed in Tables 1 and 2), four of the prevalence studies, based on national databases, are of good methodological quality (Travis *et al.*, 2004; Fullerton *et al.*, 2009; Lemke and Schaefer, 2010; Aschbrenner *et al.*, 2011). Whether the studies of Buchanan *et al.* (2002; 2003) are of similar methodological quality is not clear, because in these studies the question "Was the whole population approached?" could not be answered.

Of the prevalence studies in selected subpopulations, one is of moderate quality (de Girolamo *et al.*, 2005) and five studies (Mukherjee *et al.*, 1996; Trilling *et al.*, 1998; Schepers *et al.*, 2000; Akner, 2009; Placentino *et al.*, 2009) are of poor methodological quality. These studies were not primarily designed as prevalence studies but as descriptive studies. Hence, especially external validity is compromised.

As shown in Appendix 2 (sum scores are displayed in Table 3), the other five studies (Cuijpers and Van Lammeren, 1999; Jongenelis *et al.*, 2004; Jang *et al.*, 2006; 2007; Barca *et al.*, 2009) are of similar moderate methodological quality. The most important flaw of all these studies is that determinants and outcomes were not assessed independently from each other.

Prevalence rates of mental–physical co- and multimorbidity

Of the 12 prevalence studies, only one study (Akner, 2009) describes multimorbidity in LTC residents not starting from an index disease or a group of index diseases. Akner (2009) identified a total of 275 separate chronic health conditions in a sample of 70 nursing home residents. The residents had a mean of 17 different chronic health problems. The most prevalent chronic health conditions were neuropsychiatric, cardiovascular, and gastrointestinal conditions.

In 4 studies, the prevalence of comorbid depression in LTC residents with a somatic index disease was investigated (Trilling *et al.*, 1998; Buchanan *et al.*, 2002; 2003; Travis *et al.*, 2004). This prevalence varied from 20.7% in residents with HIV to 36% in residents with MS.

The other 7 studies describe the prevalence of comorbidity in LTC residents with a psychiatric disorder (Trilling *et al.*, 1998; Buchanan *et al.*, 2002; 2003; Travis *et al.*, 2004; Fullerton *et al.*, 2009; Lemke and Schaefer, 2010; Aschbrenner *et al.*, 2011). Several differences in the prevalence of mental and medical comorbidities were found, depending on the primary psychiatric disorder, age, and residential setting. Prevalence ranged from 0.5% (any psychiatric illness + psoriasis) to 64.7% (substance use disorder + gastrointestinal disorder) (Tables 4 and 5).

Characteristics and care needs of residents with both mental and physical disorders

Characteristics of LTC residents with mental–physical multimorbidity were embedded in the text of the studies rather than the primary focus of research. Therefore, for the second research question, relevant information is presented here as a narrative description.

Aschbrenner *et al.* (2011) found that newly admitted nursing home residents with serious mental illness (SMI) were younger and more likely to become long-stay residents than those admitted with other conditions. Newly admitted residents with SMI had higher rates of psychiatric histories and psychiatric medication use but lower rates of dependence in transfer and less need for assistance with activities of daily living (ADLs).

Lemke and Schaefer (2010) found that, compared with other residents, the residents with SUDs were more likely to be younger, male, African–American, unmarried, and have a low income. SUD residents were more independent in ADLs. They were more likely to engage in verbal disruption but not in other problem behaviors such as aggression.

Fullerton *et al.* (2009) found that, compared with those who had neither mental illness nor dementia, residents with mental illness were in general younger and white (except for those with schizophrenia). Those admitted with schizophrenia or an anxiety disorder were less educated. Residents with schizophrenia or bipolar disorder were less likely to be married, had lower ADL scores, and had higher levels of cognitive impairment than those with depression, anxiety disorder, or those who had neither mental illness nor dementia.

Placentino *et al.* (2009) and de Girolamo *et al.* (2005) reported that the majority of mentally ill residents in Italian LTC facilities was male, middle-aged (40–64 years), and had never been married.

Buchanan *et al.* (2002) found that patients with HIV with depression were more likely to be older, female, and white than other residents with HIV. HIV residents with depression were approximately twice as likely as other residents with HIV to have a

history of mental health conditions; also, they were more likely to have unsettled relationships, such as conflicts with staff, family, or friends; unstable health conditions; to be at the end stage of disease; and to have other diseases and infections.

In his other study, Buchanan *et al.* (2003) found that patients with MS with depression were more likely to be younger and female than other residents with MS; they were more likely to have a history of mental health conditions and to have unsettled relationships. Both groups of MS residents had high levels of physical disability, although MS residents with depression tended to be slightly less disabled, were more likely to experience daily pain, and to have the diseases common to residents with MS.

None of the studies included in this review had examined care needs of residents with both mental and physical disorders.

Associations between mental and physical disorders

Of the 5 studies that investigated associations between mental and physical disorders, all concern associations between depression and medical conditions or health-related variables (Table 3).

In these studies, the following risk factors for depression were found: pain (Cuijpers and Van Lammeren, 1999; Jongenelis *et al.*, 2004), stroke (Jongenelis *et al.*, 2004), number of chronic conditions (Jang *et al.*, 2006; Barca *et al.*, 2009), functional impairment (Cuijpers and Van Lammeren, 1999; Jongenelis *et al.*, 2004; Jang *et al.*, 2006), negative life events (Cuijpers and Van Lammeren, 1999; Jongenelis *et al.*, 2004), and negative health perceptions (Jang *et al.*, 2007).

Discussion

Main findings

This is the first systematic review of the literature describing older adults with multimorbidity of both physical and mental illnesses, other than dementia, living in LTC facilities.

Prevalence rates

We found only one study (Akner, 2009) on multimorbidity, focusing on the whole range of chronic physical and mental morbidity affecting older persons in an LTC facility. In this study, among 70 LTC residents in Norway, nearly all patients were suffering from mental–physical multimorbidity. Because this study was conducted in a relatively small population, results are not generalizable. Therefore, the prevalence of multimorbidity of a wide range of chronic

psychiatric and somatic conditions in a residential LTC population remains unclear.

All other studies included in this review show prevalence rates of comorbid physical and mental illnesses. These rates range from 0.5% (any psychiatric illness + psoriasis) to 64.7% (substance use disorder + gastrointestinal disorder). Depression appears to be the most studied psychiatric disorder. The prevalence of comorbid depression in LTC residents with a physical illness ranges from 20.7% to 36%.

These prevalence rates roughly correspond to the prevalence of mental–physical comorbidity in community-dwelling elderly (Haworth *et al.*, 2005; Yohannes, 2005; Reijnders *et al.*, 2008; Robinson and Spalletta, 2010). This means that the diseases in themselves may not be the decisive factor for admission to an LTC facility. LTC residents probably have more severe symptoms and impairments than home-living elderly with the same diseases. Therefore, it is of great importance that research on multimorbidity focuses not only on diagnoses but also on the ensuing symptoms, impairments, and care needs.

Characteristics and care needs

The findings here show that LTC residents with mental–physical multimorbidity are more likely to be younger, male, and unmarried than other LTC residents. Also, these residents more often have problem behavior and cognitive impairment but no dementia, whereas results regarding the need for assistance with ADLs are inconclusive. These differences in characteristics indirectly point to different care needs for LTC residents with and without mental–physical multimorbidity. Therefore, it is remarkable that there is no published research into the care needs of residents with mental–physical multimorbidity. This seriously hampers political decision making on the strategies for future LTC delivery. In economic terms, Say's law will work, that is, people will ask for the care that is made available by the system. From a patient's perspective, it should be vice versa; the health care system should provide the care that is asked for by patients, based on their individual needs.

Associations between mental and physical disorders

Studies into associations between physical and mental disorders other than depression were not found. This is regrettable because these psychiatric disorders are common in the population of LTC residents without dementia (Seitz *et al.*, 2010) and will only further increase by political trends

to minimize the traditional asylum function of psychiatric hospitals.

More knowledge about associations and risk factors can contribute to improving the diagnostic process and to preventing or reducing complications due to specific (co)morbidity.

Methodological considerations

A limitation of any systematic review is the potential omission of relevant articles.

In this review, only studies with a substantive description of both chronic medical and psychiatric conditions were involved. Studies on multimorbidity only recording the number of diseases were excluded because in these studies it is not clear whether they concern purely somatic multimorbidity or mental–physical multimorbidity. Furthermore, dementia was excluded *a priori* in the search strategy. Studies on dementia, however, might have secondary objectives relevant for the present review.

The study methods used in the selected studies vary and have some limitations.

Two studies were entirely or largely performed in VA nursing homes (Trilling *et al.*, 1998; Lemke and Schaefer, 2010), whereas these have a special resident population. Most notably, VA nursing home residents are predominantly men, in contrast with the population of community nursing homes (Lemke and Schaefer, 2010).

In 5 studies, data from the MDS were used (Buchanan *et al.*, 2002; 2003; Travis *et al.*, 2004; Fullerton *et al.*, 2009; Aschbrenner *et al.*, 2011). The MDS is an important measurement tool used in the United States by the Centers for Medicare & Medicaid Services and the state health regulators. MDS data are collected for all nursing facility residents in the Medicare- and Medicaid-certified facilities and are used for two main purposes: to determine the appropriate daily case-mix nursing facility reimbursement rate for Medicare and Medicaid payment and to create the MDS quality indicators (Bellows and Halpin, 2008). These purposes lead to unintended incentives for providers to both under or over-report the presence of mental illness in the MDS (Grabowski *et al.*, 2010). This is why the use of the MDS to quantify prevalence and incidence rates of mental illness in nursing homes has drawbacks. Furthermore, the MDS depends on accurate recording of information by assessment nurses, including diagnoses. Studies have generally confirmed the reliability and validity of the MDS data (Mor *et al.*, 2003), but we have to keep in mind that the recorded diagnosis is not a validated method for assigning a diagnosis (Fullerton *et al.*, 2009).

As a prevalence study, 5 of the 6 studies in selected subpopulations (Mukherjee *et al.*, 1996; Trilling *et al.*, 1998; Schepers *et al.*, 2000; Akner, 2009; Placentino *et al.*, 2009) have a moderate methodological quality because of limitations in sampling and analysis. In these studies, no probability sampling was used, which implies that the results may not be representative for all LTC residents with the studied comorbidities.

In the 5 studies in which associations between mental and physical disorders were investigated (Cuijpers and Van Lammeren, 1999; Jongenelis *et al.*, 2004; Jang *et al.*, 2006; 2007; Barca *et al.*, 2009), a methodological limitation is the fact that the determinants (risk factors) and the outcome (depression) are not measured independently from each other. Thus, no firm conclusions can be drawn about the strength of the associations, although these are necessary for health care planning and addressing patients' care needs.

Another difficulty within the context of health care planning and addressing patients' care needs is the diversity of LTC residents with mental–physical multimorbidity without dementia. This is supported by the heterogeneity of the study populations that, despite the strict inclusion criteria, was included in this review.

An important reason for this diversity relates to differences between countries regarding the structure and the organization of the health care system. The functions of LTC facilities in the different health care systems are not uniform (Ribbe *et al.*, 1997). For instance, in the United States, the downsizing and closure of state hospitals have resulted in transinstitutionalization into nursing homes of many older persons with severe and persistent mental illness, especially those with severe psychiatric symptoms, cognitive deficits, functional and physical impairment, aggressive behaviors, and a lack of social support (Bartels *et al.*, 1997; 1999). As another example, during the process of deinstitutionalization the mental hospitals in Italy were replaced by small residential care facilities, with an average number of places of 12.5. Two-thirds of the residents have a diagnosis of schizophrenia (de Girolamo and Bassi, 2004). Finally, in the Netherlands residential facilities were developed alongside the mental hospital. Yet, this has not led to a substantial decrease in the total number of available hospital beds compared with other European countries (de Heer-Wunderink *et al.*, 2008). Nevertheless, also in the Netherlands the number of nursing home residents with mental illness other than dementia is rising, partly as a result of changed policy toward both mental health care and LTC for the elderly. International studies with similar designs across settings would reveal unique data.

Implications

Despite differences in LTC facilities, in all of them changes in the characteristics of their residents have occurred: an increasing number of them have both physical and mental problems (Fullerton *et al.*, 2009). This creates problems for maintaining the quality of care. LTC facilities for physically disabled elderly are not sufficiently staffed and funded to provide mental health care which conversely holds for physical care in mental health care facilities.

It is clear that changes in the characteristics of residents require adjustments in the informal, the community-based, and the institutional LTC system. Unfortunately, the current research findings do not answer the question which adjustments are preferred, because no information was found about care needs. Nevertheless, several authors underscore the importance of a comprehensive assessment to identify specific clinical and care needs (Akner, 2009; Placentino *et al.*, 2009). Based on these needs, individually targeted treatment plans for each resident could be formulated and pursued, with special attention for mental health needs, advance care planning, and, if possible, discharge planning (Buchanan *et al.*, 2002; 2003; Travis *et al.*, 2004; de Girolamo *et al.*, 2005; Akner, 2009; Placentino *et al.*, 2009; Lemke and Schaefer, 2010). Results of de Girolamo *et al.* (2005), Fullerton *et al.* (2009), Lemke and Schaefer (2010), and Aschbrenner *et al.* (2011) suggest that a number of nursing home residents with mental illness may have the functional capacity to live in the community if these patients could participate in appropriate rehabilitation programs during their stay in the nursing home and if there would be a strong local mental health infrastructure to deliver suitable support.

Conclusion

So far, little research has been conducted on multimorbidity, focusing on the whole range of chronic physical and mental morbidity affecting older persons in LTC facilities, although it is common in LTC residents. Given the specific characteristics of the pertaining residents, more knowledge of their specific care needs is essential to improve the quality of care for these residents.

Possibly, there is not much difference in the need for LTC among older psychiatric patients with somatic comorbidity and elderly patients with a somatic disorder and psychiatric comorbidity. More than the diagnoses, symptoms and behavior are responsible for the limitations in functioning and therefore for the content of the care needs. The split between mental and physical health care is probably not desirable for both groups of patients.

They are most likely best served by one LTC facility in which care for residents with physical disorders, residents with psychiatric disorders, and residents with mental–physical multimorbidity merges into each other in a hybrid manner. As such, radical decisions must be based on empirical findings; the first step now should be to perform research on symptoms, impairments, behavior, and care needs of LTC residents with mental–physical multimorbidity.

Conflict of interest

None.

Description of authors' roles

AvdB, DG, ROV, and RK initiated the study concept and design. AvdB carried out the search, selected the literature for review, and wrote the first draft of the paper. DG contributed to selection of the studies, their interpretation, and the writing. ROV and RK assisted in the data interpretation and in writing the review.

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Appendix 1. Methodological quality of included prevalence studies (Boyle, 1998)

		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
1	Was the target population defined clearly?	1	1	1	1	1	1	0.5	0.5	1	1	1	0.5
2	Was probability sampling used to identify potential respondents (or the whole population approached)?	1	1	1	1	?	?	0	0	1	0	0	0
3	Did characteristics of respondents match the target population?	1	0.5	1	1	?	?	?	?	?	?	0	?
4	Were the data collection methods standardized?	1	1	1	1	1	1	1	1	1	1	1	1
5	Were the survey instruments reliable?	1	1	1	1	1	1	0.5	0.5	0.5	?	0	0.5
6	Were the survey instruments valid?	0.5	?	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
7	Were special features of the sampling design accounted for in the analysis, through appropriate weighting of the data, or the whole population approached?	1	1	1	1	?	?	0	?	?	0	0	0
8	Do the reports include confidence intervals for statistical estimates or was the whole population approached?	1	1	1	1	?	?	0	0	0.5	0	0	0
	Quality score	**7.5**	**6.5**	**7.5**	**7.5**	**3.5**	**3.5**	**2.5**	**2.5**	**4.5**	**2.5**	**2.5**	**2.5**

1: Yes; 0.5: Partly; 0: No; ?: Unknown.

Appendix 2. Methodological quality of included other observational studies (van der Windt *et al.*, 2000)

		#13	#14	#15	#16	#17
1	Are valid selection criteria used in the composition of the study population?	1	0.5	0.5	1	1
2	Is the response to the first measurement at least 80%?	0.5	?	?	0	0
3	Are the determinants determined with a valid and reliable method?	1	0.5	0.5	1	0.5
4	Is the exposure to the determinant assessed independently of knowledge about the outcome?	0	0	0	0	0
5	Is the outcome determined with a valid and reliable method?	1	1	1	1	1
6	Is the outcome assessed independently of knowledge about the determinants?	0	0	0	0	0
7	Is the analysis adjusted for potential confounders?	1	1	1	1	1
8	Are there sufficient participants included in the study?	1	1	1	0.5	1
	Quality score	**5.5**	**4**	**4**	**4.5**	**4.5**

1: Yes; 0.5: Partly; 0: No; ?: Unknown.