

How Do Persons with Young and Late Onset Dementia Die?

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Abstract.

Background: End of life symptoms and symptom management as well as the quality of dying (QoD) of persons with advanced dementia (PWAD) have not yet been systematically studied in Germany.

Objective: 1) To investigate symptoms, treatment and care at the end of life, advance care planning, and circumstances of death of recently deceased PWAD; 2) To determine whether there are differences between young and late onset dementia (YOD and LOD).

Methods: The study was performed in the context of the project EPYLOGE (Issues in Palliative care for persons in advanced and terminal stages of Young-onset and Late-Onset dementia in Germany). Closest relatives of recently deceased patients with advanced YOD (N = 46) and LOD (N = 54) living at home or in long term care were interviewed.

Results: Circumstances of death, symptoms, and treatment appeared to be similar between YOD and LOD, except that persons with LOD had significantly more somatic comorbidities and were admitted to hospital in the last three months of life more often than persons with LOD. At end of life, 60% of PWAD appeared to be “at peace”. Difficulty swallowing, gurgling, shortness of breath, and discomfort were observed most frequently. Large interindividual differences in suffering and QoD were present. Determinants of QoD were not identified.

Conclusion: Our findings suggest that low QoD was caused by inadequate recognition and/or insufficient treatment of burdensome physical and emotional symptoms. PWADs’ needs should be assessed regularly, and strategies focusing on treatment and implementing support for both the patient and caregiver must be established.

Keywords: Dementia, end-of-life symptoms, home care, late onset dementia, long term care, palliative care, quality of dying, young onset dementia

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INTRODUCTION

In the last decade, end of life in dementia and palliative care has moved into the focus of various dementia and palliative care research groups. Large studies (e.g., the Dutch End-of-Life in Dementia (DEOLD) study [1] or the Implementation of Quality Indicators in Palliative Care Study) [2] have provided valuable information on the symptoms of persons with advanced dementia (PWAD) at the end of life, their care and treatment, the quality of life and death, the patients' needs, the circumstances of death, and the specific issues and requirements of family carers and nursing staff (e.g., [3–7]). Optimal palliative care in older people with dementia has been defined by van der Steen and colleagues in their white paper [8].

Despite the wealth of studies on end of life in dementia, research on particular subgroups of PWAD is scarce. For example, the topic of end of life in young onset dementia (YOD) with symptom onset before the age of 65 has been almost neglected thus far. Although these patients have been included in large study cohorts of PWAD, small sample sizes prevented subgroup analyses from being performed (e.g., [9]). Thus, symptoms and symptom management at the end of life as well as the quality of dying (QoD) in YOD have not yet been examined. A variety of differences between YOD and late onset dementia (LOD) in early disease stages have been described with regard to symptoms and therapy [10–13]. Some differences have been described for advanced disease stages: persons with YOD have less somatic comorbidities, are more mobile and have more behavioral and psychological symptoms of dementia than persons with LOD [14, 15]. Accordingly, the primary aim of our study was to find out if symptoms, treatment, and care at end of life also differ between YOD and LOD. Secondly, we aimed to investigate the circumstances of death in a large sample of recently deceased PWAD. In particular, we aimed to find out, how PWAD with very low and very good QoD were treated before death.

METHODS

Subjects

This project was performed in the context of the study EPYLOGE (IssuEs in Palliative care for people in advanced and terminal stages of Young-onset and Late-Onset dementia in Germany). The study design of EPYLOGE (ClinicalTrials.gov (NCT03364179))

is described in [16]. Advanced dementia was defined as Clinical Dementia Rating [17] global score 2 or 3. EPYLOGE consisted of two parts: In “part A” a prospective study of palliative care issues in 181 PWAD was conducted, the findings have been reported recently [15]. In “part B”, which is reported here, a postmortem interview was carried out with the closest relatives of PWAD who had died within the three-year study period of “part A” of EPYLOGE (N=52) and with relatives of recently deceased PWAD (N=48) who had additionally been identified through a large Bavarian dementia network (e.g., Munich Alzheimer Society, Alzheimer Society Germany, various long-term care facilities in Bavaria, clinical centers of the German Consortium for Frontotemporal Dementias).

Stratification was implemented, aiming to include relatives of approximately 50% persons with YOD and 50% with LOD. The study was approved by the Ethics Committee of the School of Medicine of the Technical University of Munich (No. 281/17 S).

Assessments

A neurologist with palliative care expertise (JH and CR) performed standardized interviews with closest relatives of the recently (within the preceding three months) deceased PWAD. Furthermore, all available medical and care records were studied. For the 52 PWAD who had been examined in the prospective “Part A” of the EPYLOGE-study, data about dementia etiology (according to the respective diagnostic criteria for Alzheimer's disease, frontotemporal dementia, Lewy body disease, vascular dementia, and Creutzfeldt-Jacob disease), and somatic comorbidities (according to ICD- 10 chapter II–IV and VI–XIV [18]) was available from EPYLOGE “part A”. For the remaining 48 patients, the data was retrieved from medical records, the relatives, and the collaborators who had referred the relative of the deceased PWAD to the EPYLOGE study team.

The following data were collected from PWADs' records and the interviews with the relatives: demographic data; formal level of care as assessed by the German Health Insurance Medical Service; hospitalizations during the last three months of life, medical interventions during the last three months of life (permanent bladder catheter, suprapubic catheter, percutaneous endoscopic gastrostomy (PEG), gastric tube, temporary custodial measures, cardiovascular resuscitation); non-drug treatments during the last three months of life (physiotherapy, occupational therapy,

Table 1
Assessments and questionnaires used for study purposes

Assessments (Interviews with relatives and study of medical and care records)			
Demographic data, somatic, neurologic, cognitive, and psychiatric symptoms, psychotropic drug therapy, non-drug treatment, medical interventions, presence of care planning documents, and health care utilization			
Questionnaires (alphabetic order)	Reference	Period of observation; type of survey	Interpretation
End-of-Life in Dementia Scale: Symptom Management (EOLD-SM)	[19]	90 days before death; Caregiver interview	9 subitems: pain, shortness of breath, fatigue, depression, fear, anxiety, skin breakdown, calm, resistiveness to care. Rating of frequency: never (5), once a month (4), two to three days a month (3), once a week (2), two to three days a week (1), every day (0). Total score 0–45. The higher the better symptom control.
End-of-Life in Dementia Scale: Comfort Assessment in Dying with Dementia (EOLD-CAD)	[19]	Last week before death; Caregiver interview	14 subitems: discomfort, pain, restlessness, shortness of breath, choking, gurgling, difficulty swallowing, fear, anxiety, crying, moaning, serenity, peace, calm. Rating of frequency: a lot (1), somewhat (2), not at all (3) (serenity, peace and calm are inversely coded). Total score 14 – 42. The higher the better comfort.
Mini-Suffering-State-Examination (MSSE)	[20, 28]	During process of dying; Medical opinion based on caregiver interview and medical files	10 subitems: not calm, screams, pain, decubitus ulcers, malnutrition, eating disorders, invasive action, unstable medical condition, suffering according to medical opinion, suffering according to family opinion. Total score 0–10. The higher the more suffering. Score 0–3: low level of suffering; 4–6: intermediate level; 7–10: high level.

speech/ swallowing therapy, music therapy, breathing therapy, aroma therapy, oral care, other); psychotropic drug therapy before death; place and cause of death; availability of advance care documents.

Symptoms and suffering at end of life, and quality of dying were retrospectively assessed by interviews of the closest relatives using the End-of-Life in Dementia Scale: Symptom Management (EOLD-SM) [19], the End-of-Life in Dementia Scale: Comfort Assessment in Dying with Dementia (EOLD-CAD) [19], and the Mini-Suffering-State-Examination (MSSE) [20]. These assessment instruments have been shown to be valid and reliable and are recommended for the use in populations with dementia [21]. They are described in detail in Table 1.

Statistical methods

SPSS Statistics 25.0 for Windows (Armonk, New York, USA) was used for analyses.

Continuous data were compared between the two groups using either Student's *t*-tests or the Mann-Whitney U test, depending on the distribution of variables. Categorical variables were compared by χ^2 tests or Fisher exact tests. An exploratory approach without Bonferroni corrections for multiple testing was chosen. A linear regression analysis was performed to identify determinants of QoD. The total score of the EOLD-CAD was chosen as the dependent

variable. "Age at death", "gender", "place of living" (home care versus long term care (LTC)), "etiology of dementia" (Alzheimer's disease (AD) versus frontotemporal dementia) and "place of death" (hospital versus non-hospital) were selected as independent variables based on existing evidence on (e.g. [22]), and clinical experience about determinants of quality of life and dying in dementia. The assumptions of linear regression were confirmed.

RESULTS

One hundred family caregivers of deceased persons with advanced YOD (46%) and LOD (54%) were recruited.

Demographics of the PWAD, details of the etiology of dementia, place of living, and caregiver specifics are shown in Table 2. There were considerable differences between YOD and LOD with regard to gender, marital status, the family caregiver, and dementia etiology.

Somatic comorbidities were assessed for the last three months of life. Cardiovascular diseases (YOD 18.5%, LOD 67.4%), pulmonary diseases (YOD 24.1%, LOD 39.1%), and neurological diseases (YOD 25.9%, LOD 45.7%) were most frequent. Significantly more persons with LOD than YOD suffered from cardiovascular diseases ($p=0.001$), and musculoskeletal diseases ($p=0.003$).

Table 2
Demographic data, dementia etiology, place of living, caregiver, and level of care

	YOD + LOD N = 100	YOD 46%	LOD 54%	YOD versus LOD <i>p</i>
Age at death	73.68 ± 11.859 (45 – 101)	63.87 ± 8.046 (45 – 79)	82.04 ± 7.284 (70 – 101)	< 0.001*
Sex	Female: 57.0% Male: 43.0%	Female: 43.5% Male: 46.5%	Female: 68.5% Male: 31.5%	0.012*
Marital status	Married/ in partnership: 67.0% Single: 33.0%	Married/ in partnership: 82.6% Single: 17.4%	Married/ in partnership: 53.7% Single: 46.3%	< 0.001*
Place of living [§]	At home: 39.0% LTC: 61.0%	At home: 41.3% LTC: 58.7%	At home: 37.0% LTC: 63.0%	0.663
Dementia etiology	AD: 54.0% FTLD: 35.0% Other: 11.0%	AD: 37.0% FTLD: 52.2% Other: 10.8%	AD: 68.5% FTLD: 20.4% Other: 11.1%	0.004*
If home care: family caregiver	Spouse/ partner: 76.9% Child: 18.9% Other: 5.1%	Spouse/ partner: 89.5% Child: 0.0% Other: 10.5%	Spouse/ partner: 62.6% Child: 17.9% Other: 5.1%	0.036*
Formal level of care [#] (“Pflegegrad”)	(N = 99) 4.42 ± 0.71 (3 – 5)	(N = 45) 4.56 ± 0.624 (3 – 5)	(N = 54) 4.31 ± 0.773 (3 – 5)	0.128

Mean ± standard deviation (minimum – maximum). AD, Alzheimer’s disease; FTLN, frontotemporal lobar degeneration; LTC, long-term care; LOD, late onset dementia; YOD, young onset dementia; *difference between YOD und LOD statistically significant; [§]LTC includes nursing homes and externally assisted dementia residential communities; [#]as assessed by the German Health Insurance Medical Service.

Table 3
Treatment and care in the last three months of life, availability of advance care documents, and circumstances of death

Hospitalization	38% of all PWAD; 52 hospitalizations (Internal medicine 40%, psychiatry 19%, surgery 10%, other 21%, palliative ward 10%) for adjustment of psychotropic drugs 32%, antibiotics 21%, palliative symptom control 13%, adjustment of internal/geriatric drugs 10%, other: 24%
Non-drug treatment	22% of all PWAD; physiotherapy 12%; occupational therapy 10%; speech/ swallowing therapy 6%; music therapy 1%; oral care 8%; aroma therapy 3%
Medical interventions	Permanent bladder catheter 9%, suprapubic catheter 1%, percutaneous endoscopic gastrostomy (PEG) 4%, gastric tube 1%, Temporary custodial measures 6%
Psychotropic drug therapy (point prevalence at the day of death)	Antidementia drug 10%, Antidepressant 13%, Antipsychotic 20%, Benzodiazepine 19%, Z-Substance 2%, Non-opioid-pain medication 20%, Opioid other than morphine 20%, Morphine 19%
Availability of advance care documents	Power of attorney 90%, written advance patient directive (living will) 70%, Proxy’s written advance directive 17%, written crisis plan 22%, written goals of care plans 35%, do not resuscitate order 30%, other treatment orders (e.g., “do not hospitalize”, “no PEG”) 44%
Place of death	LTC 56%, at home 26%, hospital 16% (somatic unit 10%, intensive care unit 1%, palliative care unit 3%, psychiatric unit 2%), hospice 2%
Cause of death	In 31% of PWAD we were not able to get insight into the death certificates. In the remaining cases causes of death were: pneumonia 28%, cardiovascular disease 20%, sepsis 4%, cachexia 4%, other 44%

Treatment and care in the last three months of life, circumstances of death as well as the availability of advance care documents are summarized in Table 3.

More hospital admissions were reported for LOD (45.3%) than for YOD (30.4%). This difference was statistically significant ($p=0.03$). Apart from that, however, no other significant differences were identified between YOD and LOD with regard to non-drug treatment, medical interventions, psychotropic drug therapy, availability of advance care documents, place, and cause of death. During the last three months before death 22% of PWAD (YOD 14%,

LOD 8%; $p=0.060$) received non-drug treatment. Twelve percent received physiotherapy, 10% occupational therapy, 6% speech/ swallowing therapy, and 1% music therapy. In the last days before death 8% of PWAD received oral care, and 3% aromatherapy. In the last three months of life, 9% of PWAD had a permanent bladder catheter, 1% a suprapubic catheter, 4% had a PEG, and 1% a gastric tube. Six percent of PWAD required temporary custodial measures, mainly to reduce the risk of falls (abdominal bandage, belt on the chair, attachment table, backpack belt, bed rails), in order to prevent manipulation of the bladder catheter or PEG (mittens, two-point restraint), and

in one case due to physical aggression (five-point restraint). Because of the low numbers of PWAD who received medical interventions, differences between YOD and LOD were not analyzed.

The prevalence of treatment with psychotropic drugs, non-opioid pain medication, opioids, and morphine on the day of death did not differ between YOD and LOD. 27% of PWAD received either morphine (19%), or an opioid other than morphine (20%) or a combination of opioids (12%).

Documents were searched to find out which advance care documents were available. A power of attorney was available in the vast majority of PWAD. Around 70% of PWAD had a living will. In 17% of the cases a proxy had written advance directives.

Medical and care instructions (crisis plan, therapy goals, “no rescue order”) were available in 21 to 45% of PWAD. There were no differences between YOD and LOD.

The place of death did not differ significantly between YOD and LOD ($p=0.445$). 56% of PWAD died in an LTC facility, while 26% died at home. Sixteen percent of PWAD died in a hospital (somatic unit 10%, intensive care unit 1%, palliative care unit 3%, psychiatric unit 2%) and 2% in a hospice. Causes of death were unknown in 31% of cases since we were not able to get the death certificates of the deceased PWAD. In the remaining PWAD causes of death, according to the death certificates, were: pneumonia 28%, cardiovascular disease 20%, sepsis 4%, cachexia 4%, other 44%. Causes of death did not differ between YOD and LOD ($p=0.737$).

End of life symptoms were measured with the EOLD-SM scale for the last 90 days of life. The mean EOLD-SM total score was 32.91 ± 8.432 (minimum: 11; maximum: 45) and did not differ between YOD and LOD ($p=0.950$). According to the EOLD-SM, somatic symptoms, i.e., skin breakdown (43%), pain (every day/2 to 3 days a week: 31%), and shortness of breath (every day/2 to 3 days a week: 30%), were most frequent during the last 90 days of life, followed by depression (every day/2 to 3 days a week: 25%), and resistiveness to care (every day/2 to 3 days a week: 23%). Conversely, agitation, lack of calmness, fear, and anxiety were least frequent (every day/2 to 3 days a week: < 18%).

Suffering was measured with the MSSE. The mean MSSE score was 3.49 ± 1.676 (minimum: 0; maximum: 8) and did not differ between YOD and LOD ($p=0.229$). Nonetheless, levels of suffering differed substantially between individuals. While the majority of PWAD (76.9%) had low levels of suffering (MSSE

total score 0 – 3), 19.3% had intermediate levels (score 4 – 6), and 3.8% had high levels (score 7).

Quality of dying was measured in 94 PWAD with the EOLD-CAD (for the scoring of the EOALS-CAD, see Table 1). Six PWAD died a sudden death and were not observed during dying and/ or did not have an obvious dying phase. For these cases the EOLD-CAD was not obtained. The EOLD-CAD mean score was 34.59 ± 4.687 (minimum: 24; maximum: 42). During the last week before death, difficulty swallowing was observed most frequently (67% “a lot”, 8% “somewhat”), followed by gurgling (24% “a lot”, 26% “somewhat”), shortness of breath (20% “a lot”, 29% “somewhat”), and discomfort (15% “a lot”, 24% “somewhat”). 27% suffered “a lot” or “somewhat” from pain, whereas crying, fear, and choking were found to occur least frequently. Serenity, peace, and calmness were rated “a lot” in 51%, 60%, and 65% respectively. EOLD-CAD mean scores did not differ between YOD (34.98 ± 3.795) and LOD (34.25 ± 5.340 ; $p=0.447$). Inter-individual differences in QoD were large with many PWAD having a very high and others a very low QoD.

Table 4 gives an overview of the 15 PWAD with very low (<29 points) EOLD-CAD total scores. Table 4 shows demographics, dementia etiology, place of living and death, EOLD-CAD total score and subscores, psychotropic drug therapy and pain medication before death as well as non-drug treatment, medical interventions and (palliative) care utilization during the last three months of life. The majority (73%) of PWAD with the worst QoD were persons with LOD, and 73% were male. Forty-seven percent of PWAD with very low QoD had a diagnosis of AD, 40% FTD and 13% Lewy body disease. Sixty percent lived in LTC and 40% at home. Place of death was the place of living in all cases with one exception: one patient who had lived at home was admitted to a hospital prior to death. According to EOLD-CAD subscores, QoD was particularly affected by difficulties swallowing, restlessness, and discomfort (marked in bold in Table 4). It appears that several PWAD did not receive sufficient drug therapy. Non-drug treatment was offered only to very few PWAD and was limited to oral care in three PWAD, physiotherapy in three and aroma therapy in one PWAD.

All 12 PWAD with very good QoD (EOLD-CAD total score ≥ 40) had lived in LTC prior to death. The majority (83%) were persons with LOD and AD (75%). 33% of the PWAD with the best QoD had been admitted to a hospital prior to death, and one was in a palliative care ward.

Table 4

Fifteen patients with the worst quality of dying as measured with the End-of-Life in Dementia Scale: Comfort Assessment in Dying (EOLD-CAD)

Age at death, Age group/ Dementia etiology, Place of living/ death	EOLD-CAD total score	Discomfort	Pain	Restlessness	Shortness of breath	Choking	Gurgling	Difficulty Swallowing	Fear	Anxiety	Crying	Moaning	Psychotropic drugs and pain medication before death* (including prn drugs; daily dose) Non-drug treatment, Medical interventions during three months prior to death	(Palliative) care utilization during three months prior to death
Male 68 years YOD, FTD LTC	24	1	2	2	1	1	1	1	2	2	3	2	No drugs Oral care PEG	Regular doctor visits Palliative care nurse on demand
Female 73 years LOD, AD At home	24	1	1	3	1	3	3	1	3	3	3	1	Quetiapine p.o. 25 mg, Sertraline p.o. 100 mg, Donepezile p.o. 10 mg, Novaminsulfone p.o. 1000 mg, Tilidin p.o. 100 mg, Scopolamine t.d. 1.5 mg/week No non-drug treatment PEG	Doctor visits on demand
Female 78 years LOD, AD LTC	24	1	1	2	2	2	1	1	2	2	2	2	Buprenorphine s.c. 0.8 mg No non-drug treatment	Doctor visits on demand
Female 80 years LOD, AD At home	26	2	3	3	1	2	1	1	3	3	3	3	Mirtazapine p.o. 15 mg, Fentanyl t.d. 50 µg every 3 days, Memantine p.o. 20 mg, Sertraline p.o. 100 mg, Lorazepam p.o. prn No non-drug treatment	Doctor visits on demand SAPV on demand Palliative care nurse on demand
Male 71 years LOD, LBD LTC	26	3	1	1	3	3	1	1	1	1	2	1	Lorazepam p.o. 1 mg, Morphine s.c. 10 mg, Morphine s.c. prn No non-drug treatment	Doctor visits on demand Palliative care nurse on irregular basis Hospice association counselling Dementia companion Regular doctor visits
Male 80 years LOD, FTD LTC	26	3	3	1	1	1	1	1	1	1	3	3	Fentanyl t.d., dose unknown, Morphine prn No non-drug treatment	Hospice association counselling Spiritual care on irregular basis
Male 57 years YOD, FTD LTC	27	3	3	2	1	3	1	1	2	2	2	3	Novaminsulfon prn, Morphine prn Oral care, aroma therapy No non-drug treatment	Hospice association counselling Spiritual care on irregular basis
Male 63 years YOD, FTD At home	27	1	3	2	2	3	2	1	2	2	3	1	No drug therapy No non-drug treatment	Doctor visits on irregular basis Ambulatory care service Palliative care nurse Hospice association counselling Dementia companion
Male 71 years YOD, AD LTC	27	1	3	3	3	1	1	1	3	3	2	3	Lorazepam p.o. 1 mg, Morphine s.c., dose unknown No non-drug treatment	Dementia companion
Female 78 years LOD, AD LTC	27	3	1	1	1	1	1	1	1	3	2	2	Fentanyl t.d. 50 µg every 3 days, Valproate 1200 mg, Paracetamol supp. prn, Morphine s.c. prn, Lorazepam exp. po. prn, butylscopolamine s.c. prn, Midazolam im. Prn physiotherapy, oral care No non-drug treatment PEG	Doctor visits on demand SAPV on demand Spiritual care on demand

(Continued)

Table 4
(Continued)

Age at death, Age group/ Dementia etiology, Place of living/ death	EOLD-CAD total score	Discomfort	Pain	Restlessness	Shortness of breath	Choking	Gurgling	Difficulty Swallowing	Fear	Anxiety	Crying	Moaning	Psychotropic drugs and pain medication before death* (including prn drugs; daily dose) Non-drug treatment, Medical interventions during three months prior to death	(Palliative) care utilization during three months prior to death
Male 90 years LOD, AD At home	27	2	2	3	3	3	2	1	3	2	2	2	Morphine t.d., dose unknown No non-drug treatment	Doctor visits 1x/week
Male 71 years LOD, FTD LTC	28	1	3	2	3	2	1	1	2	2	3	2	Paracetamol supp. prn, Lorazepam p.o. prn Morphine s.c. dose unknown, physiotherapy	Doctor visits 1x/week
Male 73 years LOD, FTD At home/ died in hospital	28	2	1	3	2	3	3	1	3	3	3	2	Morphine s.c. 4 mg, Midazolam s.c. 6 mg, Novalgine supp. prn, Butylscopolamine s.c. prn, Lorazepam s.l. prn, Morphine s.c. prn, Midazolam prn No non-drug treatment PEG, two-point restraint	Outpatient nursing service Dementia companion At hospital care 24/7
Male 80 years LOD, LBD LTC	29	1	1	3	3	2	3	2	3	3	2	3	Quetiapine p.o. 12.5 mg, Melperone p.o. prn, physiotherapy	Doctor visit 1x/week Palliative care nurse on demand
Male 70 years LOD, AD At home	29	2	3	1	3	3	2	1	3	2	3	1	Novaminsulfon supp. 3000 mg, Lorazepam p.o. prn No non-drug treatment	Outpatient nursing service Palliative care coordinator on demand SAPV on demand Palliative care nurse on demand Spiritual care on demand

AD, Alzheimer’s disease; EOLD-CAD, End-of-Life in Dementia Scale: Comfort Assessment in Dying; im., intramuscular; FTD, frontotemporal dementia; HC, home care; LBD, Lewy body disease; LOD, late onset dementia; LTC, long-term care; mg, milligram; PEG, percutaneous endoscopic gastrostomy; p.o., per os; prn, as needed; ret., retard; SAPV, special ambulatory palliative care; s.c., subcutaneous; td, transdermal; YOD, young onset dementia; Non-drug therapy included individualized speech/ swallowing therapy, physiotherapy (including massage, respiratory therapy, etc.) occupational therapy, aroma therapy, respiratory therapy, other therapies. Routine group therapies offered in LTC were not considered; Medical interventions included gastric tube and PEG; (Palliative) care utilization included: doctor visits, outpatient nursing service, palliative care coordinator, SAPV, palliative care nurse, SAPV, dementia companion, spiritual care. - For the sake of clarity, the inversely coded symptoms (serenity, peace, calm) are not displayed in the table; Predominant symptoms (frequency 1 = a lot) are marked **bold**. *psychotropic drugs, non-opioid pain medication, opioids, morphine, scopolamine, butylscopolamine. Further somatic drugs not noted.

A multiple linear regression analysis showed that QoD as measured with the EOLD-CAD was not associated with age group, age at death, gender, place of living, place of death, or etiology of dementia (see Table 5).

DISCUSSION

To the best of our knowledge, our postmortem study is the first to compare circumstances of death, end of life symptoms and treatment, as well as QoD between persons with advanced YOD and LOD.

Overall, we detected few differences between YOD and LOD in the three months prior to death. Unsurprisingly, somatic comorbidities were significantly more frequent in LOD. Accordingly, significantly more persons with LOD were admitted to a hospital in the last three months before death than those with YOD. End of life symptoms, suffering, and QoD were similar in YOD and LOD. YOD patients tended to receive more non-drug treatment than LOD, but this difference was not significant. Moreover, there were no differences with regard to the administration of psychotropic drugs, pain medication, and morphine prior to death. Lastly, the causes and locations

Table 5

Multiple regression analysis results for associations between End-of-Life in Dementia Scale (EOLD-CAD) total scores and independent variables age group (YOD versus LOD), age at death, gender, place of living (HC versus LTC), place of death (hospital versus not hospital) and etiology of dementia (AD versus FTD)

	Regressions coefficients	Standard error	<i>p</i>	95% Confidence Interval	
				Lower Bound	Upper Bound
(constant)	31.541	5.975	<0.001	19.633	43.449
Age group YOD/LOD	-3.201	1.729	0.068	-6.648	0.245
Age at death	0.118	0.081	0.150	-0.043	0.279
Gender (male/female)	-0.815	1.090	0.457	-2.988	1.357
Place of living (home care/ LTC)	1.109	1.113	0.323	-1.110	3.327
Place of death hospital (yes/no)	2.125	1.459	0.150	-0.783	5.033
Dementia etiology (AD/ FTD)	-1.342	1.274	0.296	-3.880	1.197

Dependent variable: EOLD-CAD score. AD, Alzheimer's disease; EOLD-CAD, End-of-Life in Dementia Scale: Comfort Assessment in Dying; FTD, frontotemporal dementia; LTC, long-term care; LOD, late onset dementia; YOD, young onset dementia.

of death, and the prevalence of advance care documents and treatment orders additionally did not differ between groups. Despite the fact that traditional end of life and palliative care primarily serve elderly PWAD, the lack of major differences between YOD and LOD allows the assumption that the less common group of dying persons with advanced YOD is not disadvantaged.

With the large number of 100 deceased PWAD, our study was able to provide important insights into the circumstances of death, symptoms, treatment, and care at the end of life in Germany.

We found that the vast majority of PWAD living in LTC died in LTC. Obviously, LTC facilities aim to provide PWAD the opportunity to die in familiar surroundings. On the contrary, 38% of the PWAD who were cared for at home, were admitted to a hospital before death. This might reflect that several family caregivers were overwhelmed during the final stages and/or that the support at home became insufficient.

Although only 18% of PWAD died in a hospital, 38% of PWAD had been admitted to a hospital at least once during the three months prior to death. Correspondingly, albeit to a greater extent, a recent Bavarian study of 58 deceased PWAD found that 47% were admitted to a hospital in the 30 days before death [23]. The main indications for hospital admissions in our study were adjustment of psychotropic drugs and antibiotics. Since hospitalization can be a particular burden for PWAD, these treatments should preferably be provided on an outpatient basis whenever possible, i.e., through home visits by the PWADs' primary care providers.

Interindividual differences of QoD were large. Sixty percent of PWAD were "at peace", a result that is—although direct comparisons between studies

must be made with caution—very similar to the findings of a Dutch study that demonstrated that 56% of 233 deceased PWAD in LTC had died "peacefully" [24]. Nonetheless, several PWAD in the present study had a disturbingly low QoD.

In the group of 15 PWAD with the worst QoD, it appeared that the symptoms assessed with the EOLD-CAD were either not recognized, not treated effectively, or were unresponsive to treatment. Specific (palliative) non-drug treatment such as music, aroma, massage therapy, and oral care, recommended to prevent or relieve end of life suffering was severely lacking. However, this insufficiency of non-drug treatment was not just in those with the worst QoD but was evident cohort-wide. In actuality, very few PWAD in our study received non-drug treatment. In the 15 PWAD with the worst QoD, we further noticed that in some cases drug therapy was either not appropriate or was not sufficient enough to alleviate physical and emotional distress.

Twenty-seven percent of all PWAD in our study were prescribed opioids (morphine or non-morphine opioid) on the day of death. This is much lower than the 77% of 330 PWAD reported by the Dutch "DEOLD" study [25]. Considering that within the last seven days before death almost half of the PWAD in our study suffered from shortness of breath, and 27% from pain, we conclude that the palliative treatment administered was not sufficient for many PWAD.

It is undisputed that advance care planning has positive effects on care and treatment [26]. Vandervoort et al. [27] showed that patients with a written advance directive had lower emotional distress in the last week of life. In our study, 70% of PWAD had a living will. Such directives are extremely helpful when it comes to decision making at the end of life. Once the

decision to stop life-prolonging therapies has been made, subsequent goals of care plans, contingency plans, and medical treatment orders provide certainty and clarity to the practitioner and the family while further preventing burdensome treatment. We were surprised about the rather low prevalence of these documents in our cohort. Medical and care providers as well as the families need to be better informed about the meaning and purpose of advance care documents, so that many more goals of care plans, contingency plans, and medical treatment orders are written for PWAD.

A linear regression analysis showed, that neither the age group (YOD or LOD), the place of living (at home or LTC), the etiology of dementia (AD or FTD), or the place of death (hospital or at home/ LTC) had an effect on QoD.

Thus, PWAD who died in a hospital did not have a lower QoD than those who died in their home environment. Interestingly, one third of the twelve PWAD who had the best QoD died in a hospital. In some cases, palliative medical treatment of physical and emotional symptoms requires close monitoring and regular adaptation of medication. This can often only be achieved in a hospital. Ideally, when recommended after careful individual consideration, patients should be admitted into dementia-friendly hospitals with palliative care experience, or, if necessary, into a palliative care ward.

It must be noted that this study was not without limitations. First, a selection bias occurred as a result of recruiting through a University Hospital memory clinic and a large Bavarian dementia network. The majority of the PWAD and their caregivers had already found their way into a system that provides education and counselling, possibly resulting in better care and treatment at the end of life. Another limitation was the use of retrospective reports of the relatives (medical laypersons) to investigate end of life symptoms and QoD. Although all interviews were performed within three months after the PWAD's death, a memory bias cannot be excluded. Furthermore, since it is often difficult for medical staff to correctly (differential-) diagnose particularly the emotional symptoms in PWAD, it is even more a challenge for medical laypersons. Finally, it is still not clear how to define a high QoD in PWAD. We assume that QoD is high when patients appear calm and relaxed, rather than agitated or in pain. Unfortunately, though, conclusions can only be made from observations and what PWAD really feel will remain unknown.

CONCLUSION

Undoubtedly there is a need for end-of-life palliative care for patients suffering from dementia. The PWADs' needs must be assessed regularly, and supportive treatment strategies should be adapted accordingly. It is important to identify PWAD who suffer from physical or emotional symptoms, and then alleviate those symptoms by establishing, monitoring, and adjusting effective drug and non-drug treatment. Additionally, providing counselling and support to family caregivers of PWAD who live and die at home is crucial. To do so, the incorporation of palliative care coordinators would be desirable. Likewise, it must be highlighted that a hospital admission before death does not necessarily result in a reduced QoD. Lastly, informing medical and care providers as well as patients' families about the meaning and purpose of advance care documents might increase the number of written therapy goals, contingency plans, and GP orders which will alleviate burdensome treatment and provide certainty and clarity to all involved.

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