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Received: 17 November 2019 | Accepted: 25 February 2020

DOI: 10.1002/gps.5290

RESEARCH ARTICLE

International Journal of Geriatric Psychiatry WILEY

Comfort and clinical events at the end of life of nursing home residents with and without dementia: The six-country epidemiological PACE study

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Funding information
European Union's Seventh Framework Programme (FP7/2007e2013), Grant/Award Number: 603111; Marie Curie Innovative Training Network (ITN) action, H2020-MSCA-ITN-2015, Grant/Award Number: 676265

Abstract

Objectives: We aimed to investigate the occurrence rates of clinical events and their associations with comfort in dying nursing home residents with and without dementia.

Methods: Epidemiological after-death survey was performed in nationwide representative samples of 322 nursing homes in Belgium, Finland, Italy, the Netherlands, Poland, and England. Nursing staff reported clinical events and assessed comfort. The nursing staff or physician assessed the presence of dementia; severity was determined using two highly discriminatory staff-reported instruments.

Results: The sample comprised 401 residents with advanced dementia, 377 with other stages of dementia, and 419 without dementia (N = 1197). Across the three groups, pneumonia occurred in 24 to 27% of residents. Febrile episodes (unrelated to pneumonia) occurred in 39% of residents with advanced dementia, 34% in residents with other stages of dementia and 28% in residents without dementia (P = .03). Intake problems occurred in 74% of residents with advanced dementia, 55% in residents with other stages of dementia, and 48% in residents without dementia (P < .001). Overall, these three clinical events were inversely associated with comfort. Less comfort was observed in all

resident groups who had pneumonia (advanced dementia, $P = .04$; other stages of dementia, $P = .04$; without dementia, $P < .001$). Among residents with intake problems, less comfort was observed only in those with other stages of dementia ($P < .001$) and without dementia ($P = .003$), while the presence and severity of dementia moderated this association ($P = .03$). Developing "other clinical events" was not associated with comfort.

Conclusions: Discomfort was observed in dying residents who developed major clinical events, especially pneumonia, which was not specific to advanced dementia. It is crucial to identify and address the clinical events potentially associated with discomfort in dying residents with and without dementia.

KEYWORDS

dementia, hospice care, nursing homes, palliative care, terminal care

1 | INTRODUCTION

As populations continue to age, the number of people with dementia in Europe is projected to almost double to about 18.8 million by 2050.[1] Dementia is incurable and characterized by a trajectory of severe disabilities persisting for months or years until death.[2,3] Because of the prolonged need for high levels of complex care,[2] half or more of people with dementia in many resource-rich countries eventually live and die in nursing homes (NH).[4] Recent estimates indicate that between 58% and 83% of NH residents have dementia, about half may be at an advanced stage.[5] While comfort may be an appropriate goal of care, residents with advanced dementia remain at risk of dying with great discomfort, potentially linked to suboptimal symptom management, overly burdensome treatments and unnecessary hospitalizations, and dying in hospitals.[2,6-10]

At the end of life, "clinical events," that is, any medical conditions that may lead to clinically significant changes in health status for example, pneumonia, febrile episodes (unrelated to pneumonia), and intake problems, often occur in residents with advanced dementia, which is why it is considered a terminal condition.[2,7] However, studies suggest that such events are almost as common in moderate dementia.[10,11] While residents increasingly have dementia,[6,10] those without dementia are often very frail, highly care-dependent and have multiple comorbidities that also predispose them to developing clinical events.[6,12] It is therefore of interest to examine clinical events in residents with and without dementia, while taking dementia severity into account. Further, comfort while dying may differ between these groups, because the inability to verbalize a complaint due to cognitive decline risks inappropriate treatment.[13] Different clinical events have also been associated with different levels of comfort, with those dying from infections being at greater risk of discomfort than those dying with intake problems.[11,14-16] Therefore, a better understanding of associations between dementia, clinical events, and comfort when dying will be helpful. The PACE study provides this opportunity, with relevant epidemiological data about many NH residents for whom the presence and severity of dementia was determined.[17]

We sought to determine the rates of occurrence of clinical events in the last month of life and their associations with comfort in the last week of life of NH residents with advanced dementia, other stages of dementia and without dementia.

Key points

- It is crucial to better understand associations between the presence and severity of dementia, clinical events and comfort at the end of life of nursing home residents.
- Our six-country epidemiological after-death survey showed that pneumonia is associated with lower comfort in all dying nursing home residents, while intake problems are associated with lower comfort only in those without advanced dementia.
- Partially in contrast to earlier studies, our findings suggest that pneumonia is not a hallmark of advanced dementia, while intake problems are.
- Our study stresses an urgent need to address symptoms of pneumonia in a mixed nursing home population with and without dementia and supports current recommendations to forego tube feeding in residents with advanced dementia.

2 | METHODS

2.1 | Design

We used data collected in the context of the PACE study, which is an epidemiological study using after-death questionnaires to collect data about residents in nationwide representative samples of NHs in Belgium, Finland, Italy, the Netherlands, Poland, and England (2015).[17] The PACE study protocol and the results regarding the quality of dying and quality of end-of-life care of residents have been published.[5,17] The six countries represent different stages of development

of palliative care policies and practice; Belgium, the Netherlands, and England are at a more advanced stage of palliative care development.[18] In each country, NHs were selected using proportional stratified random sampling, taking region, NH type, and bed capacity into account.[17] They were sampled from national lists in all countries except Italy, where samples were taken from a previously created cluster of NHs covering three macroregional areas and taking bed capacity and facility types into account.[19] To improve the participation rate in England, additional NHs were recruited through ENRICH, a specialist research network for NHs.[17]

2.2 | Setting and participants

"NHs" were collective institutional settings where on-site resident care is provided 24/7.[20] In 322 participating NHs, data were collected on 1384 deceased residents with an overall response rate of 82%. Nonresponse analysis revealed no significant difference in age, sex, length of stay, and place of death whether staff returned questionnaires or not.[6] Residents for whom the presence and severity of dementia could be determined were divided into three groups: advanced, other stages, and no dementia.

2.3 | Data collection

All PACE researchers were trained extensively to ensure standardized data collection across the countries.[17] A letter introducing the study was sent to NH directors/owner/manager asking for voluntary participation and telephone or e-mail contact was made. In each participating NH, a contact person (a NH administrator, head nurse, or manager) was appointed. Assisted by a researcher, the contact person retrospectively identified all residents who died in and outside the facilities over the previous three-month period. Using administrative files, the contact person filled in a structured checklist, which consisted of two parts. Part A contained identifiable names of residents and respondents, which was kept in the NH and never accessible to the researchers for the privacy of both residents and respondents. Part B contained pseudonymized codes. The contact person used the structured checklist to assign codes to paper after-death questionnaires, which he/she mailed to respondents. For each resident identified, questionnaires were distributed to nursing staff who were most involved in their care (preferably a nurse or, if not available, a care assistant), NH administrator/manager/head nurse and treating physician (general practitioner or elderly care physician). The contact person sent up to two reminders (ethics committees allowed only one in Poland and England). Respondents mailed the questionnaires directly to the research team.[17]

2.4 | Measurements

2.4.1 | The presence and severity of dementia

Dementia was considered present if the nursing staff and/or the treating physician indicated it, and no dementia where both indicated it or one where the other did not return the questionnaire or did not answer the question. To compare with earlier studies,[2,11,21,22] we defined the stages of dementia using two highly discriminatory staff-reported instruments, cognitive performance scale (CPS) and Global Deterioration Scale (GDS).[23,24] CPS uses five variables from the Minimum Data Set to group residents into six hierarchical cognitive performance categories, with higher scores indicating worse cognitive impairment.[23] GDS classifies dementia into seven stages, of which stage 7 indicates very severe cognitive decline with minimal to no verbal communication; incontinence/require assistance to eating and toileting; and loss of basic psychomotor skills.[24] Among residents with dementia, those with CPS scores of 5 to 6 and GDS stage 7 were considered to have advanced dementia, while the rest had other stages of dementia.

2.4.2 | Clinical events in the last month of life

Clinical events in the last month of life were determined by asking the nursing staff if the resident suffered from one or more of the following events: pneumonia, febrile episodes (unrelated to pneumonia), eating or drinking problem, hip fracture, stroke, gastrointestinal bleeding, cancer, or other important events. Whether these "other important events" can be considered clinical events was discussed by R.M., J.V.D.S., T.S., and N.V.D.N., who have research, nursing, and medical backgrounds. Pneumonia, febrile episodes, and intake problems were considered as major categories of clinical events.[2] Another category was created for the occurrence of hip fracture, stroke, gastrointestinal, or other clinical events (eg, muscular atrophy or subdural hematoma). We excluded cancer (n = 146) because we could not determine whether cancer had only developed in the last month of life.

2.4.3 | Comfort in the last week of life

Comfort in the last week of life was assessed by the nursing staff using a validated 14-item scale: comfort assessment in dying-end-of-life in dementia (CAD-EOLD).[25,26] CAD-EOLD comprises four subscales: physical distress, dying symptoms, emotional distress, and well-being. Total scores range from 14 to 42, with higher scores representing more comfort. CAD-EOLD has better psychometric properties and user-friendliness than other comfort measures including a mixed NH population with and without dementia.[27-29]

2.4.4 | Potential confounders

Potential confounding factors considered were age when dying, sex, length of stay in NHs and place of death, all of which were reported by NH administrators. Place of death may differ between people with and without dementia and this has been shown to affect comfort of people with advanced dementia.[30] We also determined whether the respondent was a nurse or other staff.

2.5 | Data analyses

Analyses were conducted in IBM SPSS statistics version 25 (© IBM Corporation). We reported resident characteristics, occurrence rates of the clinical events, and comfort by group (dementia). We presented the frequencies for the CAD-EOLD total scores along with estimated marginal means and 95% confidence intervals (CI). To account for the multilevel nature of the data (eg, residents nested within country, NHs, or nursing staff most involved in care), generalized linear mixed models (GLMM) analyses were performed. First, we compared resident characteristics, occurrence rates of the clinical events, and comfort between the groups. Second, in the total sample, we estimated the association between each clinical event and comfort. Third, separately for each of the groups, we estimated the association between each clinical event and comfort. Finally, to investigate whether this association differed between the three defined groups, we conducted association analyses in the total sample while adding the interaction term "dementia*clinical events" as a covariate in the models. All association analyses were adjusted for age, sex, length of stay, and place of death. All variables that were fitted in the GLMMs can be found in Table S1. Sensitivity analyses explored comfort of residents who had combined pneumonia and intake problems or febrile episodes and intake problems. Testing was two-sided. Statistical significance was set at $P < .05$.

2.6 | Ethics

In each country, we obtained ethical approval from respective ethics committees or waivers to collect data of deceased residents (Netherlands and Italy). The respondents participated voluntarily and returning a questionnaire was taken as consent to participation.

3 | RESULTS

3.1 | Resident characteristics

The sample comprised 1197 residents, of whom 401 had advanced dementia, 377 had another stage of dementia, and 419 had no dementia. At the time of death, residents with other stages of dementia were the oldest (mean age 86.6 years), followed by those with advanced dementia (mean age 85.5 years) and those without dementia (82.4 years; $P < .001$, Table 1). All groups were predominantly female, in particular 60% (without dementia), 63% (with other stages of dementia), and 68% (with advanced dementia) ($P = .04$). Those with advanced dementia had the longest length of stay (63% one year or more, 26% six months or less), followed by those with other stages of dementia (58% one year or more, 31% six months or less) and those without dementia (50% one year or more, 42% six months or less; $P < .001$). The majority died in the NH, in particular 69% without dementia, 72% with other stages of dementia, and 78% with advanced dementia ($P = .001$).

3.2 | Clinical events and comfort

In the last month of life, 24% to 27% of residents in all groups had pneumonia (no group difference; $P = .91$; Table 2). Febrile episodes

TABLE 1 Resident characteristics by resident groups (N = 1197)

	Advanced dementia (N = 401)		Other stages of dementia (N = 377)		No dementia (N = 419)		Between-group difference *P*-values[a]
Age at time of death, mean [SD]	85.5	[7.9]	86.6	[7.8]	82.4	[11.6]	**<.001**
Sex, female n (%)	274	(68)	239	(63)	250	(60)	**.04**
Place of death[b], nursing home n (%)	311	(78)	270	(72)	287	(69)	**.001**
Length of stay in nursing home, n (%)							
Up to 6 months	101	(26)	110	(31)	164	(42)	**<.001**
6–12 months	41	(11)	40	(11)	33	(8)	
1 year or more	239	(63)	206	(58)	198	(50)	
Respondent for resident, n (%)							.83
Nurse most involved in care[c]	306	(76)	287	(76)	302	(72)	
Other staff most involved in care[d]	91	(23)	87	(23)	113	(27)	

Note: Missing data: advanced dementia: age = 12 (3%); sex = 15 (4%); place of death = 12 (3%); length of stay = 20 (5%); respondent for resident = 4 (1%) | other stages of dementia: age = 14 (4%); sex = 10 (3%); place of death = 19 (5%); length of stay = 21 (6%); respondent for resident = 3 (1%) | no dementia: age = 25 (6%); sex = 19; place of death = 19 (5%); length of stay = 24 (6%); respondent for resident = 4 (1%). The bold entries significant *p*-values, with the statistical significance set at $P < 0.05$.

Abbreviation: SD, standard deviation.

[a]Calculated using generalized linear mixed model analyses to account for correlation of data within country and nursing homes; "other" categories not included in calculation of *P*-values.

[b]Examples of places of death other than nursing homes include facility hospice/palliative care unit or general ward and ICU in hospital.

[c]Nurse most involved in care included registered nurse, head nurse/matron and reference nurse; and licensed practical nurse in Finland.

[d]Other staff most involved in care included nursing assistants, care assistants, and other nursing role.

TABLE 2 Clinical events and comfort by resident groups (N = 1197)

	Advanced dementia (N = 401)		Other stages of dementia (N = 377)		No dementia (N = 419)		Between-group difference *P*-values[a]
Clinical events, n (%)							
Pneumonia	102	(25)	100	(27)	101	(24)	.91
Febrile episode	155	(39)	128	(34)	118	(28)	**.03**
Intake problem	297	(74)	206	(55)	200	(48)	**<.001**
Other clinical events[b]	76	(19)	68	(18)	99	(24)	.24
CAD-EOLD total scores,[c] n (%)	384	(96)	358	(95)	385	(92)	
Estimated marginal means, (95% CI)	30.7	(29.3-32.1)	31.3	(29.9-32.7)	31.2	(29.7-32.6)	.25

Note: Missing data: CAD-EOLD: advanced dementia = 17 (4%); other stages of dementia = 19 (5%); no dementia = 34 (8%). The bold entries significant *p*-values, with the statistical significance set at $P < 0.05$.

Abbreviations: CAD-EOLD, comfort assessment in dying-end of life dementia scale; CI, confidence interval.

[a]Calculated using generalized linear mixed model analyses to account for correlation of data within country, nursing homes, and nursing staff most involved in care.

[b]"Other clinical events" was considered present if any of the following clinical events was reported: hip fracture, stroke, gastrointestinal bleeding, and other events reported.

[c]Total scores are averages per whole scale multiplied by total number of items (ie, 14). Cases with missing values on more than 25% of items per scale were excluded from total score calculation; scores range from 14 to 42; higher scores indicate better comfort at death.

occurred at different rates in residents with advanced dementia (39%), other stages of dementia (34%) and without dementia (28%; $P = .03$). Similarly, intake problems occurred in advanced dementia (74%), other stages of dementia (55%) and without dementia (48%; $P < .001$). Across the groups, the occurrence rates of "other clinical events" ranged from 18% (advanced dementia) to 24% (without dementia; $P = .16$). The estimated marginal means of comfort total scores did not differ ($P = .25$), while it ranged from 30.7 in advanced dementia to 31.3 in other stages. For combined occurrence of major clinical events, sensitivity analyses showed no substantial difference in the association with comfort in the three groups (Table S2).

3.3 | Associations between clinical events and comfort

We found that comfort was inversely associated with pneumonia ($P < .001$), febrile episodes ($P = .001$) and intake problems ($P < .001$). No significant association was found between "other clinical events" and comfort ($P = .83$). Results persisted after adjustment for confounding factors.

3.4 | Associations between clinical events and comfort in the three resident groups

3.4.1 | Pneumonia

In all groups, the estimated mean comfort scores were lower among residents who had pneumonia than those who did not (Table 3, crude models 1). Among those with pneumonia, comfort scores amounted to approximately 30 (between 29.2 for those without dementia and 30.3 for those with other stages of dementia). Among those who did not have pneumonia, comfort scores were 31.1 (advanced dementia) and 31.6 in the other two groups. The presence and severity of dementia did not moderate the association between pneumonia and comfort ($P = .30$). After adjustment for confounding factors, the association between lower comfort and pneumonia remained significant in all groups with no moderation by dementia (Table 3, adjusted models 1).

3.4.2 | Febrile episodes (unrelated to pneumonia)

Only those with other stages of dementia who had febrile episodes had lower comfort scores than those who did not have febrile episodes (30.1 vs 31.8, $P = .003$, Table 3, crude models 2). Although not statistically significant, a similar pattern of association between febrile episodes and comfort was found in those with advanced dementia and without dementia; the association did not differ between groups ($P = .78$). The results were similar after adjusting the analyses for confounding factors (Table 3, adjusted models 2).

3.4.3 | Intake problems

Among residents with other stages of dementia and without dementia, those with intake problems had lower comfort scores than those without (Table 3, crude models 3). However, intake problems were not associated with comfort in advanced dementia ($P = .65$). These results persisted after adjustment for confounding factors (Table 3, adjusted models 3). The presence and severity of dementia did not moderate the associations between intake problems and comfort in the crude models ($P = .052$), but it did after adjustment for confounding factors ($P = .03$).

To better understand the differential associations between intake problems and comfort, we performed two secondary analyses. First,

TABLE 3 Associations between clinical events and comfort by resident groups (N = 1197)

Association analyses		Advanced dementia (N = 401)		Other stages of dementia (N = 377)		No dementia (N = 419)		
		CAD-EOLD total scores[b]						
Models	Clinical events	Estimated marginal means (95% CI)	*P*-values[c]	Estimated marginal means (95% CI)	*P*-values[c]	Estimated marginal means (95% CI)	*P*-values[c]	Between-group difference in the association *P*-values[a]
Pneumonia								
Crude models 1	Yes	29.8 (28.1-31.5)	**.03**	30.3 (29.0-31.6)	**.03**	29.2 (27.5-30.8)	**<.001**	.30
	No	31.1 (29.6-32.6)		31.6 (30.5-32.7)		31.6 (30.2-32.9)		
Adjusted models 1	Yes	29.5 (27.7-31.3)	**.04**	30.2 (29.0-31.4)	**.04**	28.9 (27.4-30.3)	**<.001**	.33
	No	30.8 (29.2-32.4)		31.6 (30.6-32.6)		31.3 (30.0-32.5)		
Febrile episodes (unrelated to pneumonia)								
Crude models 2	Yes	30.1 (28.6-31.7)	.11	30.1 (29.0-31.3)	**.003**	30.4 (29.0-31.9)	.18	.78
	No	31.0 (29.6-32.5)		31.8 (30.8-32.8)		31.3 (30.0–32.5)		
Adjusted models 2	Yes	29.7 (28.1-31.4)	.10	29.9 (28.7-31.1)	**.004**	29.9 (28.6-31.2)	.09	.77
	No	30.7 (29.2-32.2)		31.7 (30.8-32.7)		31.0 (30.0-32.0)		
Intake problems								
Crude models 3	Yes	30.7 (29.2–32.2)	.65	30.3 (29.2-31.4)	**<.001**	30.2 (28.8-31.5)	**.004**	.052
	No	30.9 (29.2-32.6)		32.5 (31.3-33.6)		31.8 (30.5-33.1)		
Adjusted models 3	Yes	30.4 (28.7-32.4)	.78	30.0 (29.0-31.0)	**<.001**	29.7 (28.6-30.9)	**.003**	**.03**
	No	30.6 (28.7–32.4)		32.4 (31.4-33.4)		31.4 (28.6-30.9)		
Other clinical events								
Crude models 4	Yes	30.3 (28.5-32.1)	.40	30.6 (29.0-32.1)	.24	31.7 (30.0-33.4)	.21	.14
	No	30.8 (29.4-32.3)		31.4 (30.4-32.4)		30.9 (29.5-32.2)		
Adjusted models 4	Yes	30.2 (28.2-32.1)	.63	30.1 (28.6–31.7)	.13	31.4 (29.9-32.8)	.23	.12
	No	30.5 (28.9-32.1)		31.3 (30.4-32.2)		30.5 (29.5-31.6)		

Note: Crude models, crude associations between each of the clinical events and comfort; Adjusted models, adjusted for residents' age at time of death, sex, length of stay in nursing homes and place of death. The bold entries significant *p*-values, with the statistical significance set at $P < 0.05$.
Abbreviations: CAD-EOLD, Comfort Assessment in Dying-End of Life Dementia Scale; CI, confidence interval.
[a]In addition to the previous GLMM analyses, the interaction term "dementia*clinical events" was added as a covariate.
[b]Total scores are averages per whole scale multiplied by total number of items (ie, 14). Cases with missing values on more than 25% of items per scale were excluded from total score calculation; scores range from 14 to 42; higher scores indicate better comfort when dying.
[c]Calculated using generalized linear mixed model (GLMM) analyses to account for correlation of data within country, nursing homes, and nursing staff most involved in care.

we examined whether potential differences in administration rates of enteral or parenteral nutrition and fluid may have confounded this association. We found group differences in the administration rates of enteral nutrition ($P = .005$), for which we adjusted the analyses. However, this did not change the results (Table S3). Second, we investigated the associations between intake problems and the four CAD-EOLD subscales. We found similar patterns of associations between intake problems and the subscale "dying symptoms," but none between intake problems and "well-being." Only in residents with other stages of dementia were intake problems associated with the subscales physical and emotional distress. After further adjustment for enteral administration of nutrition, only the association between intake problems and "physical distress" differed between the groups ($P = .049$; Table S4).

3.4.4 | Other clinical events

In all groups, "other clinical events" was not associated with comfort. The presence and severity of dementia did not moderate the association between "other clinical events" and comfort (Table 3, crude models 4). These results persisted after adjusting for confounding factors (Table 3, adjusted models 4).

4 | DISCUSSION

Our study demonstrates that in the last month of life about a quarter of NH residents developed pneumonia across the three groups of residents with advanced, other stages and no dementia. Febrile episodes

and intake problems were more common, but occurrence rates differed between groups; those with advanced dementia more frequently developed febrile episodes and intake problems. Overall, developing these three major clinical events was associated with less comfort, but this varied according to the presence and severity of dementia. While the presence and severity of dementia did not moderate a consistently negative association between pneumonia and comfort across the three groups, it did moderate the association between intake problems and comfort. Among residents who developed intake problems, less comfort was observed only in residents with other stages of dementia and without dementia. Developing "other clinical events" was not associated with comfort in any of the groups.

Overall, our findings suggest that the major clinical events are associated with discomfort when dying, particularly pneumonia, which affects about a quarter of the NH population regardless of the presence and severity of dementia. While earlier studies regard pneumonia and intake problems as hallmarks of advanced dementia,[2,7,11] our study provides evidence that partially suggests otherwise. The finding that the occurrence rates of pneumonia and its association with comfort did not differ between the three groups suggests that pneumonia is not a hallmark of advanced dementia but can possibly be related to frailty more generally.[31,32] The distressing respiratory symptoms of pneumonia, for example, dyspnea, labored/rapid breathing or dry/hacking cough, may be perceived as profoundly uncomfortable for affected residents.[33-36] Further, even among cognitively impaired residents who could not communicate, breathing difficulties remain easily observable.[36-38]

Our findings concur with earlier studies suggesting that intake problems are a hallmark of advanced dementia.[2,11,39] In line with earlier studies,[2,11,40] our findings suggest that intake problems are common in residents with advanced dementia. Further, we found that compared with residents without dementia and with other stages of dementia, intake problems were more likely to occur but remarkably less likely to be negatively associated with comfort in residents with advanced dementia. These results persisted even after accounting for potential differences in administration rates of enteral or parenteral nutrition and fluid. Perhaps nursing staff perceive intake problems as "natural" or inherent in advanced dementia and may not link them with discomfort.[7,40] However, a genuine difference is more likely, as we used a validated scale to assess (dis)comfort, inviting staff to consider each of 14 items separately.[27-29] Further, causes may differ; residents with advanced dementia often develop intake problems gradually, whereas in frail residents without dementia, intake problems may develop more suddenly secondary to acute infections or other conditions.[41,42] Our study suggests that the cause and origin of intake problems, which can be multifactorial, may differ between those with advanced dementia and without dementia. Nonetheless, this finding supports current recommendations to forego tube feeding in residents with advanced dementia, as it may be burdensome and lack clinical benefit in ameliorating malnutrition, maintaining skin integrity or preventing aspiration pneumonia.[7,43] Tube feeding-related complications were also found to account for about half of all emergency department visits in advanced dementia.[44]

Further, we found that "other clinical events" was associated with neither comfort nor dementia status, maybe because this category is too heterogeneous, for example, muscular atrophy may not cause substantial discomfort.

4.1 | Implications for clinical care and research

Our study provides more insight into the associations between different clinical events and comfort at the end of life in NH residents with advanced, other stages and no dementia. It highlights an urgent need for physicians, and especially nurses, to be aware that developing pneumonia likely involves substantial discomfort in all, regardless of the presence and severity of dementia.[45] While this finding may not be surprising,[16] it is remarkable that despite numerous efforts to improve end-of-life care in NHs, pneumonia still seems to cause considerable suffering. Providing those who are dying with symptom-relieving treatments such as antipyretics, opioids, or oxygen may promote comfort and relieve suffering.[36] Nonetheless, it should be considered that there is a myriad of potential causes of pneumonia and there may be no single approach to address related discomfort.[46] In the future, more research is needed to develop and evaluate interventions that can improve comfort in a mixed NH population with pneumonia.

Finally, although intake problems may not be associated with comfort in residents with advanced dementia, if such problems are present it remains essential to consider rigorous clinical assessment to exclude acute conditions (eg, stroke) and to address easily-reversible causes (eg, dental problems).[7,40] High-calorie supplements and other oral feeding options can also be offered to this population as an alternative to tube feeding.[47] Further, while we found that intake problems may be associated with discomfort in residents without dementia and with other stages of dementia, the evidence base to guide clinicians about artificial nutrition and hydration is still small.[40,48] Clinicians can address intake problems after careful assessment and consideration of different options as guided by the goals of care that should be discussed where possible with the resident who is dying and those close to them.[40,48] Nevertheless, future research should explore differences in the cause and origin of intake problems and pneumonia and investigate how they relate to comfort in those with and without dementia.

4.2 | Strengths and limitations

This is the first study to examine associations between dementia, clinical events, and comfort in dying NH residents. Retrospective data collection through the nursing staff most closely involved in care is a feasible method for large-scale population-based epidemiological studies on the end of life. This limits potential bias in prospective sampling related to the underrepresentation of people who live longer than the study follow-up period or who have dementia for whom the terminal phase is difficult to predict. The CAD-EOLD scale, which was used to measure comfort in the last week of life of residents has been

shown to be valid in advanced dementia, less advanced dementia, and mixed NH population.[27-29] However, because data were collected after death, there might be some recall bias. Finally, given the cross-sectional nature of data, we could not explore whether the timing of the occurrence of intake problems relate to the observed discomfort in residents with advanced dementia (ie, temporal relationship). Further, we could not make causal inferences between clinical events and comfort.

5 | CONCLUSIONS

Overall, developing clinical events such as pneumonia, febrile episodes, and intake problems was associated with discomfort in dying NH residents. However, this negative association varied according to the presence and severity of dementia only for particular events. Regardless of the presence and severity of dementia, discomfort was observed in residents who had pneumonia, while among residents who had intake problems, discomfort was observed only in those without dementia and with other stages of dementia. To promote comfort in dying NH residents, it is crucial to identify and manage symptoms of the clinical events potentially associated with substantial discomfort, especially pneumonia in a mixed NH population with or without dementia.

ACKNOWLEDGMENTS

The authors thank all NHs and their staff for participating in this project; the Ministry of Science and Higher Education of Poland (decision NR3202/7.PR/2014/2 dated November 25, 2014); the ENRICH network for their support in recruiting NHs in England; Nanja van Dop for data collection in Belgium and for assistance in data cleaning; and Jane Ruthven for language editing.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

All authors meet criteria for authorship as stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. All authors gave final approval of the submitted manuscript and agreed to be accountable for all aspects of the work. All authors' specific contributions are listed below.

- Study concept and design: R.M., J.T.V.D.S., T.S., L.D., M.K., K.S., G.G., and L.V.D.B.
- Acquisition of data: T.S., N.V.D.N., S.P., M.K., K.S., G.G.
- Analysis and interpretation of data: R.M., J.T.V.D.S., T.S., N.V.D.N., L.D., M.K., S.P., K.S., G.G., and L.V.D.B.
- Preparation of manuscript: R.M., J.T.V.D.S., T.S., N.V.D.N., L.D., M.K., S.P., K.S., G.G., and L.V.D.B.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Miranda R, van der Steen JT, Smets T, et al; on behalf of PACE. Comfort and clinical events at the end of life of nursing home residents with and without dementia: The six-country epidemiological PACE study. *Int J Geriatr Psychiatry*. 2020;35:719–727. https://doi.org/10.1002/gps.5290