ORIGINAL INVESTIGATION

Withholding Antibiotic Treatment in Pneumonia Patients With Dementia

A Quantitative Observational Study

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Background: Pneumonia is a life-threatening disease in nursing home patients with dementia. Physicians and families face choices about whether to withhold antibiotics when patients are expected to die soon or when treatment may be burdensome. However, little information exists on what factors influence this complex decision-making process.

Objective: To identify factors associated with decisions on whether to withhold curative antibiotic treatment in patients with dementia who have pneumonia.

Methods: We performed an observational cohort study with 3-month monitoring for cure and death. Patients with pneumonia (N=706) were enrolled in nursing home units for patients with dementia from all over the Netherlands (61 nursing homes). Characteristics of patients, physicians, and facilities were related to the outcome of withholding antibiotic treatment.

Results: In 23% of the patients, antibiotic treatment was withheld. The other patients received antibiotics with palliative (8%) or curative (69%) intent. Compared with the patients who received antibiotics with curative intent, patients in whom antibiotic treatment was withheld had more severe dementia, had more severe pneumonia, had lower food and fluid intake, and were more often dehydrated. In addition, withholding antibiotics occurred more often in the summer and in patients with an initial episode of pneumonia. Characteristics of facilities and physicians were unrelated to the decision. However, considerable variation occurred in how patient age, aspiration, and history of pneumonia were related to decision making by individual physicians.

Conclusions: In the Netherlands, antibiotic treatment is commonly withheld in pneumonia patients with severe dementia who are especially frail. Understanding the circumstances in which this occurs can illuminate the international discussion of appropriate dementia care.

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PNEUMONIA OCCURS frequently in nursing home patients.[1] It is a potentially life-threatening infectious disease,[1-3] especially in patients with end-stage dementia.[4] From studies in US nursing homes, it seems that most pneumonias are treated with antibiotics.[5-7] Residents with pneumonia are also often admitted to the hospital.[1,8-11] However, patients with dementia are frequently excluded from studies.[12] In fact, as early as 1979, withholding curative treatment was observed in US nursing homes by Brown and Thompson.[13] Their classic study on nontreatment in 9 extended care facilities in Seattle, Wash, showed that 41% of respiratory infections were (intentionally) not treated with antibiotics and/or patients were not hospitalized.

Moreover, during the last decade, questions have been increasingly raised on treatment decisions for patients with advanced dementia.[4,12,14,15] In a study on hospitalized patients, Morrison and Siu[4] observed that pneumonia was not considered a terminal diagnosis in patients with end-stage dementia, despite the high probability of death. They questioned whether these patients should have received as many burdensome procedures as cognitively intact persons.

With progressive dementia, patients also become incompetent to make decisions.[16-18] They become unable to balance the benefits and burdens of treatments themselves. Physicians and families may consider curative treatment too burdensome and benefits too small if life expectancy is short and aggressive procedures would be required; therefore, they decide to withhold treatment.[12,19] Attempting cure may cause a burden when, for example, intravenous hydration or antibiotics require restraints to prevent removal of the intravenous line.[4,20] In addition, the

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PATIENTS AND METHODS

Between October 1, 1996, and July 31, 1998, we identified 706 consecutive pneumonia patients in psychogeriatric units of Dutch nursing homes in the Pneumonia Study. Dutch nursing homes are divided into somatic (physical disability) and psychogeriatric units. Most (96%) of the patients in the latter units have dementia and stay within the unit the rest of their lives. Physicians undergo a 2-year training program following their basic clinical training to become certified as a nursing home physician. These physicians belong to the staff of the nursing homes. Facilities employ physicians in a ratio of 1 full-time physician to 100 patients.[28-31] Even after hours or on weekends, ill residents are seen at the bedside; telephone consulting is not usual practice in the Netherlands.

The Pneumonia Study was performed in 61 facilities all over the Netherlands affiliated with our department and covered 24% of all long-term psychogeriatric (dementia) care beds in the country.[30] Nursing home physicians in training (similar to a residency in the United States) at these facilities participated in the study in 2 ways: by reporting on their own patients and by monitoring form completion on all enrolled patients in the facility. The treating physician (whether regular staff or a trainee) was responsible for completing all data forms. Because facilities had agreed to participate, the physicians' effort was considered part of their employment. The physicians were informed of the 2 main study goals: guideline development and assessing clinical predictors for the course of pneumonia.

The patients had to meet the following criteria: (1) have a psychogeriatric disease (almost always dementia); (2) reside in the nursing home for at least 4 weeks; and (3) be diagnosed as having pneumonia by the physician. The physicians were explicitly instructed to include terminal patients as well. A patient could be included only once, even if a second episode of pneumonia occurred during the study period.

The study protocol was approved by the medical ethics committee of the VU University Medical Center. Confidentiality of data was guaranteed by physicians providing coded information to the researchers (as opposed to patient or physician names). Informed consent was not deemed necessary by the ethics review committee because physicians were simply reporting information gleaned from usual practice. However, patients and families were informed of the study and were provided the opportunity to refuse transfer of data to the researchers.

DATA COLLECTION

Patients were assigned to treatment solely on the basis of the decision of the physician. Each patient was followed up for 3 months, during which incident cure (recovery as judged by the treating physician) and death were monitored continuously. The physicians completed questionnaires about the patients at the time of the treatment decision that described the patient's current condition (baseline) and their condition 2 weeks earlier (variables recorded are displayed in **Table 1** and **Table 2**). Rehydration therapy was assessed 3 days after the treatment decision. Demographic data on the physicians and the facility characteristics were obtained during site visits by one of the authors (J.T.v.d.S.). During a limited period (from March 1, 1997, until the end of data collection), data on expected outcomes, advanced care planning, food intake, weight loss, and vaccination for influenza were collected.

We used scales specifically developed for patients with severe dementia. Discomfort was measured at baseline (also retrospectively) using the 9-item observational Discomfort Scale–Dementia of Alzheimer Type,[32] which ranges from

potential benefit of treatment is decreased in patients with dementia considering their diminished expected life span, altering the risk-benefit ratio.[12] Some even raise the question if further exposure to the deteriorating course of the dementia process represents an undue burden of pneumonia treatment.[16] In considering benefits and burdens of the treatment options, open discussions with family members are highly desirable for all parties involved.[21]

Little is known about which factors influence decisions about whether to withhold antibiotic treatment in incompetent patients. Even less is known on variation among physicians with respect to these considerations. Until now, studies have relied on reporting of physicians' opinions in discussions on life-sustaining treatment[22,23] or on hypothetical cases (vignettes).[24,25]

In the Netherlands, as in Great Britain,[26] physicians are culturally and legally responsible for the ultimate decision about withholding treatment in incompetent patients. Good practice, however, involves consultation with families to reconstruct patients' wishes if their present wish is unknown or to discuss what is in the patients' best interest if no wish could be reconstructed.[17,27]

In this article, we examine factors associated with the decision to withhold antibiotic treatment in nursing home patients with pneumonia and severe dementia and the variation among physicians regarding this decision. Characteristics of nursing home patients with dementia, their treating physicians, and the facilities are reviewed to look at sources of variation in withholding antibiotic treatment. Our data provide insight into the factors that influence decision making and should facilitate the international debate among physicians on this controversial issue.

RESULTS

PATIENTS AND TREATMENTS

Treatment with antibiotics was withheld in 23% (AB-withheld) of the 706 patients in the Pneumonia Study. A few patients (8%) were treated with antibiotics according to their physicians for palliative reasons (AB-palliative), whereas all others (69%) were treated with antibiotics for curative reasons (AB-curative).

Table 3 describes the characteristics of the treatments used in the patients who were treated promptly. Antibiotics were overwhelmingly given orally. In AB-withheld patients, symptom relief in general and opiates specifically were instituted more often than in AB-

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0 (no observed discomfort) to 27 (high level of observed discomfort). The physicians were instructed on the proper use of the scale during a training session in which an instructional videotape was shown. Several studies[32-36] have demonstrated acceptable reliability and validity. A small study indicated acceptable reliability of retrospectively assessed data (J.T.v.d.S., H.J.A., J. van Assendelft, MD, M. Kooistra, MD, P. Passier, MD, and M.E.O, unpublished data, 1997). The severity of dementia before the onset of pneumonia was measured at baseline, referring to the condition before the pneumonia, with the Bedford Alzheimer Nursing Severity Scale (BANS-S).[37] This scale consists of assessments on seven 4-point items rating cognitive deficits, functional deficits, and occurrence of pathologic symptoms, of which the separate items are considered relevant with respect to decision making as well. Summed scores range from 7 (no impairment) to 28 (complete impairment). The BANS-S is a valid measure with discriminative power even in patients with severe dementia, including those with dementias other than Alzheimer disease.[38] Subjective clinical judgment on illness severity was rated on a numeric rating scale running from 1 (not ill) to 9 (moribund).[39]

STATISTICAL ANALYSIS

The patients selected for analysis in this article included those in whom antibiotic treatment was withheld (AB-withheld) and those in whom antibiotic treatment was promptly initiated with the explicit goal of curing the patient (AB-curative). Patients treated with antibiotics according to the treating physician for palliative reasons (AB-palliative) are described only. The χ^2 statistic for contingency tables was used to test for differences between AB-withheld and AB-curative patients in proportions of symptom relief. Independent sample nonparametric tests were used to compare time until death or recovery.

The relation of patient, physician, and facility variables with the treatment decision was first examined with univariate logistic regression analysis. Next, using forward stepwise logistic regression analysis, a multivariable model for withholding antibiotic treatment was constructed. Odds ratios (ORs) and 95% confidence intervals (CIs) were computed. All facility, physician, and patient variables that were univariately related were candidates for entry, except for the global measure on clinical judgment of illness severity because it was not considered specific enough to provide the desired information. Pneumonia symptoms were grouped to assess relevance compared with other conditions. The variables collected during a limited period were tested in the final model only to preserve power. Accounting for the hierarchical structure of the data, in which variables at the facility, physician, and patient level were present, we used logistic multilevel analysis.[40,41] This allows assessment of the level of variation, that is, to test whether patient variation, physician variation, or facility variation best explains the results. The multilevel modeling was performed with respect to variation on the physician level. Therefore, where the random contribution to a variable could not be neglected, there was a lack of uniformity among physicians with respect to that variable. This implies that physicians weighed such a variable differently in their decisions. Model performance (calibration and discrimination)[42] was tested using the Hosmer-Lemeshow goodness-of-fit statistic (C test)[43] and the area under the receiver operating characteristic curve (c statistic), respectively.[44] Finally, to examine which items of the summary measures in the model were most important, the summary measures were replaced by their separate items. The multilevel analysis was performed with the computer program MlwiN[45]; all other analyses were performed using SPSS statistical software for Windows, version 7.5, except for model performance, which was performed using version 9.0 (SPSS Inc, Chicago, Ill).

curative patients ($P<.001$). Only 0.6% (n=4) of all patients were admitted to a hospital at any time during the disease course. In these patients, antibiotic treatment had been started in the nursing home initially. Further analyses are restricted to the 165 AB-withheld patients and 470 AB-curative patients treated promptly. Most patients had severe dementia (**Table 4**), with an average BANS-S score of 17.5. (For comparison, in a study of Alzheimer patients, an average BANS-S score of 17.1 has been associated with an average Mini-Mental State Examination[46] score of 5.0.[38])

PHYSICIANS' EXPECTATIONS

At the time of the treatment decision, the physicians expected 96% of AB-withheld patients (55/57) to die within "a short or a somewhat longer time" when withholding antibiotics (the sample size is smaller because we asked this question for only a limited portion of the study). However, in 37% (n=21) of these cases, physicians believed that the patients would have been cured (28% [n=16] partly and 9% [n=5] fully) if they had been treated with antibiotics. The physicians expected that 98% (136/139) of the AB-curative patients would be at least partly cured within 1 month.

FACTORS THAT INFLUENCE DECISION MAKING

Most of the more than 50 patient factors tested proved to be univariately significantly related to withholding antibiotic treatment (Table 1 and Table 2). The strongest association in univariate analysis was with the clinical judgment of illness severity at the time of the treatment decision (OR, 2.7 per point increase on a 9-point scale; 95% CI, 1.8-3.9). The illness severity of AB-withheld patients could be characterized as severe (mean value, 7.1), and AB-curative patients were moderately to severely ill (mean value, 5.4). Furthermore, strong associations were found with dehydration (OR, 5.6; 95% CI, 3.9-8.3), the illness severity 2 weeks before the treatment decision (OR, 1.9 per point increase on the 9-point scale; 95% CI, 1.6-2.1), and eating dependency at the time of the treatment decision (OR, 5.4; 95% CI, 3.3-9.0).

Because unexpectedly in the youngest quartile of patients (<80 years) antibiotic treatment was more often withheld, age was tested for its relation with a variety of possible relevant variables. The younger pneumonia patients actually had higher scores of discomfort at the time of the treatment decision, had more severe dementia, and were more severely ill at the time of and before the treatment decision. Nevertheless, for these patients the ill-

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Table 1. Characteristics of Patients, Physicians, and Facilities Associated With Withholding Antibiotic Treatment in Univariate Analyses

Patient
Time of the treatment decision: summer, at weekdays
Demographics: age
Pneumonia: number of physical symptoms or signs of pneumonia of 8,* aspiration pneumonia
General health condition: urine incontinence and fecal incontinence,† cerebrovascular disease, neoplasms, weight loss during last 6 mo, insufficient food intake during last 2 wk, insufficient drinking on average during last week, dehydration, prevalence and increase‡ of pressure ulcers,† >9 h/d in bed,† illness severity rating by clinical judgment,† (increase in) eating dependency,‡ (increase in) dressing dependency,‡ mobility dependence, discomfort†
Psychogeriatric disease: vascular dementia, dementia severity
Patient-related factors: advanced care planning, not having had pneumonia in the last 12 mo
Physician
None
Facility
Number of beds for psychogeriatric patients
Other
Proportion of the patients in a nursing home estimated incompetent by their physicians, nursing home not situated in a religious area

*Abnormal chest auscultation, malaise, fever (temperature >38.8°C or twice within >24 hours >37.8°C); tachypnea, respiratory distress, coughing, Cheyne-Stokes respiration, decreased alertness.

†Both at the time of the treatment decision and 2 weeks before.

‡Increases relate to the period of 2 weeks before the treatment decision.

ness severity was less predictive of withholding antibiotic treatment (OR, 1.9; 95% CI, 1.4-2.4) than for older patients (OR, 3.3; 95% CI, 2.5-4.3). Of the physician and facility characteristics, the only significant characteristic was the number of psychogeriatric beds in the facility: a small number was predictive of withholding antibiotic treatment more frequently (OR, 1.2 per 50 beds less; 95% CI, 1.1-1.4).

FACTORS THAT INFLUENCE DECISION MAKING INDEPENDENTLY

Illness severity by clinical judgment seemed to be the strongest independent predictor of withholding antibiotic treatment. **Table 5** gives a more specified model, which did not include illness severity, and shows that the most important independent predictors of withholding antibiotic treatment were all patient factors. Severe dementia was the strongest predictor in this model. Other independently significant predictors were number of symptoms of pneumonia, insufficient drinking, dehydration, treatment in the summer, aspiration, and previous pneumonia.

The most significant item of the BANS-S for severity of dementia with respect to withholding antibiotic treatment proved to be eating dependency 2 weeks before the treatment decision. Likewise, of pneumonia symptoms, decreased alertness was more important than Cheyne-Stokes respiration, tachypnea, coughing, respiratory distress, fever, malaise, and abnormal chest auscultation.

Advanced care planning (results used in decision making in 59% of cases), if included in the final model of Table 5 (data not shown), was also an important independent predictor (OR, 3.3; 95% CI, 1.4-7.4; n=243). It hardly affected the ORs of the other variables in the model. In addition, there were no significant differences in the characteristics of the model between patients for whom advanced care planning had taken place and for whom this had not taken place (total group, AB-curative, or AB-withheld).

Table 2. Characteristics of Patients, Physicians, and Facilities Not Statistically Significantly Associated With Withholding Antibiotics in Univariate Analyses

Patient
Demographics: sex
General health condition: increased urine or fecal incontinence, increased* mobility dependence, increased* illness severity, increased* discomfort
Psychogeriatric disease: Alzheimer dementia, mixed dementia
Patient-related factors: vaccinated for influenza in prior winter
Physician
Sex, age, certified as nursing home physician or in training, experience as a physician in the nursing home
Facility
Religious affiliation, situated in 1 of the 3 biggest cities, level of policy making (availability of mission statement, quality policy, quality manual, and quality report on 4-point scale), protocol or policy on (non) treatment available, total number of beds, number of beds for somatic patients

*Increases relate to the period of 2 weeks before the treatment decision.

VARIATION IN CONSIDERING PATIENT CHARACTERISTICS

Facilities varied negligibly in withholding antibiotic treatment (variation on nursing home level in multilevel analyses). However, variation with respect to withholding antibiotic treatment at the physician level was about 5 times larger than at the patient level. This was owing to variation in importance for withholding antibiotic treatment attributed to certain patient characteristics. Namely, the best fitting model allowed random variation for 3 of the 8 factors in the model of Table 5 (age, aspiration, and having previously had pneumonia). This indicated that for these factors, the OR varied among physicians. The individual physicians seemed to vary in the degree to which these predictors were considered when deciding to withhold treatment. Thus, the physicians varied more in their treatment of patients younger than 80 years as opposed to older patients, in patients who previously had pneumonia as opposed to not having prior pneumonia, and in patients who were thought to have aspirated compared with patients for whom this was not thought to be the cause of pneumonia.

The values of the other 5 predictors in the multilevel model of Table 5 seemed almost equally important among individual physicians when deciding to withhold antibiotic treatment. Modeling only these 5 predictors (dementia severity, number of pneumonia symptoms, insufficient drinking, dehydration, and treatment in the summer) showed that model discrimination was as good as discrimination of the complete model, including the variables that showed random variation (area un-

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Table 3. Description of the Treatments Started*

Treatment	AB-Curative, % (n = 470)	AB-Palliative, % (n = 50)	AB-Withheld, % (n = 165)
Antibiotic type			
Amoxicillin	61	62	. . .
Amoxicillin and clavanulate potassium	20	16	. . .
Doxycycline	10	10	. . .
Other	9	12	. . .
Oral administration of antibiotics	88	86	. . .
Symptom relief for pneumonia			
Any kind†	44	72	85
Opiates	1	8	38
Invasive rehydration started within 3 d‡	3	0	1
Parenteral or tube feeding started	1	2	1

*AB-curative indicates patients treated with antibiotics for curative reasons; AB-palliative, patients treated with antibiotics for palliative reasons; AB-withheld, patients in whom antibiotic treatment was withheld; and ellipses, data not applicable. AB-withheld, AB-palliative, and AB-curative patients were treated promptly (without delay) and constitute 97% of the total patient population of 706 patients.

†Antipyretics or nonsteroidal anti-inflammatory drugs, oxygen, hypnotics or sedatives or anxiolytics (benzodiazepines), opiates, or other.

‡Hypodermoclysis, nasogastric tube, or intravenous rehydration instituted within 3 days after the treatment decision. Patients who had died within 3 days were assigned "no rehydration."

der receiver operating characteristic curve, 0.85 compared with 0.86 for the complete model), as could be expected.

DISEASE COURSE

Most of the AB-withheld patients (90%) died within 1 month, as did 48% of the AB-palliative patients. Of the AB-curative patients, 27% died within 1 month. Moreover, most of the AB-withheld patients who died during the 3-month follow-up period died within a few days (median, 2 days), which was considerably earlier than the AB-curative patients who died despite antibiotic treatment (median, 11.5 days; all $P<.001$ in this section). Median time until death of AB-palliative patients was 5.5 days. Twelve AB-withheld patients survived. The time for their recovery (median, 9.5 days) was not significantly different from the recovery time of the AB-curative patients (median, 10 days). Median recovery time for AB-palliative patients was 9 days.

COMMENT

Most patients with dementia in Dutch nursing homes who develop pneumonia are treated with antibiotics, typically given orally. Nevertheless, in 23% of patients, antibiotic treatment is withheld. Physicians think antibiotics could have saved the lives of 37% of these patients. Almost two thirds were expected to have died even if treated with antibiotics. Characteristics of facilities, such as religious affiliation, and physician characteristics were not associated in multilevel analysis with the treatment chosen and thus did not seem to substantially influence the decision making. Several patient characteristics entered as fixed effects at the physician level in the multilevel model and thus seem to be uniformly considered by physicians in decision making. However, 3 variables entered as random effects at the physician level, which suggests substantial variation among physicians in how these patient characteristics are considered in decision making.

Table 4. Description of the 635 Patients Treated Without Antibiotics or Treated With Antibiotics for Curative Reasons*

Patient Characteristic	Average or Frequency
Age, mean (SD), y	83.6 (7.4)
Female, %	62
Dementia type (*DSM-IV* criteria), %	
Alzheimer dementia	58
Vascular dementia	19
Mixed dementia	9
BANS-S score, mean (SD)	17.5 (4.8)
Comorbidity, %	
Congestive heart failure	20
Chronic respiratory disease	19
Diabetes mellitus	16
Cerebrovascular disease	14
Extrapyramidal disorders	8
Ischemic heart disease	10
Neoplasms	6

**DSM-IV* indicates *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; BANS-S, Bedford Alzheimer Nursing Severity Scale. In patients with Alzheimer disease, an average BANS-S score of 19.3 has been associated with most (92%) of the patients scoring 0 on the Mini-Mental State Examination (MMSE[46])[37]; in addition, an average BANS-S score of 17.1 has been associated with an average MMSE score of 5.0 in patients with Alzheimer disease, and in patients with vascular dementia, a BANS-S score of 18.7 was associated with an MMSE score of 4.7.[38]

The typical patient with dementia in whom antibiotic treatment is withheld is severely ill. Patients have severe dementia, have severe pneumonia (many symptoms), have low intake of food and fluids, and are often dehydrated. In addition, withholding antibiotics occurs more often in the summer. These characteristics alone are highly predictive of withholding treatment (apparent from excellent model fit), and they are considered in the same way. However, variation occurs on the importance placed on not having had pneumonia previously, aspiration, and a relatively young age. Most physicians and families were inclined to treat with antibiotics those patients who had survived pneumonia before and

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Table 5. Predictive Multilevel Model of Withholding Antibiotic Treatment in Contrast to Curative Antibiotic Treatment*

Factor	AB-Withheld	AB-Curative	OR (95% CI)
Age of patients in the first quartile, mean (SD), y	82.3 (7.8)	84.1 (7.2)	1.4 (0.9-2.4)†
BANS-S score, mean (SD)‡	20.4 (3.9)	16.5 (4.6)	2.2 (1.6-2.9) Per 5-point increase
No. of pneumonia physical symptoms and signs of 8, mean (SD)§	5.6 (1.2)	4.9 (1.2)	1.5 (1.2-1.8) Per symptom more
Insufficient drinking (<1500 mL/d) vs sufficient during last wk, %‖	77	39	2.7 (1.7-4.5)
Dehydrated (severely or mildly) vs not dehydrated, %‖	73	33	2.7 (1.6-4.4)
Treatment in summer months, %	29	13	2.2 (1.3-3.8)
Aspiration as a possible or probable cause of pneumonia, %‖	67	36	1.8 (1.1-2.9)
Patient had not had pneumonia previously in the last 12 mo, %	81	72	2.0 (1.1-3.4)

*Model performance: Hosmer-Lemeshow: $\chi^2_8 = 2.83$; $P = .94$; area under receiver operating characteristic curve = 0.86. AB-withheld indicates patients in whom antibiotic treatment was withheld; AB-curative, patients treated with antibiotics for curative reasons; OR, odds ratio; CI, confidence interval; and BANS-S, Bedford Alzheimer Nursing Severity Scale.

†Age was included because it explained much of the random variation in the model.

‡In patients with Alzheimer disease, an average BANS-S score of 19.3 has been associated with most (92%) of the patients scoring 0 on the Mini-Mental State Examination (MMSE[46])[37]; in addition, an average BANS-S score of 17.1 has been associated with an average MMSE score of 5.0 in patients with Alzheimer disease, and in patients with vascular dementia a BANS-S score of 18.7 was associated with an MMSE score of 4.7.[38]

§Pneumonia physical symptoms and signs: abnormal chest auscultation, malaise, fever (temperature >38.8°C or twice within >24 hours >37.8°C), tachypnea, respiratory distress, coughing, Cheyne-Stokes respiration, decreased alertness.

‖For interpretive clarity, oral fluid intake (continuous), dehydration (4-point scale), and aspiration as a possible cause of pneumonia (3-point scale) are presented here as dichotomous variables; however, the original scales were used in computing the models.

for most of whom (96%) an active approach had been used. In contrast, others seemed to consider recurrent pneumonia one of the reasons to withhold antibiotic treatment. Similarly, some physicians (and families) tended to withhold treatment in patients who aspirated or were relatively young, whereas others did not.

Management of pneumonia in advanced dementia may exhibit considerable variation in treatment internationally. Our findings suggest that Dutch physicians tend to uniformly withhold antibiotics in some patients but vary in the weight they place on other factors. Variation might be expected to be even greater in countries such as the United States where there is much less ethical or legal clarity about when to initiate a strictly palliative hospice approach for dementia. Our findings illuminate the international discussion on this topic by showing which patients do not receive antibiotic treatment in a setting where such practices are common.

Severity of dementia (or deterioration) has been associated with withholding antibiotic treatment independently in both the current study and other observational studies.[13,47] In our study, patients in whom antibiotics were withheld had an average BANS-S severity of dementia score of 20.4. A study[37] of the BANS-S suggests that more than 90% of these patients would have a score of 0 on the Mini-Mental State Examination.

Antibiotic treatment was also often withheld in patients with dehydration and insufficient drinking. Antibiotic treatment may have been expected to be less effective or to cause drug-related toxic effects.[48] Furthermore, the (in)dependent intake of food and fluids may have a subjective (symbolic) meaning as well, because effects were independent. Considerations other than medical may also have played a role in withholding antibiotic treatment in relatively young patients in whom, though more ill, the general illness severity was less predictive. This was most evident for the 37% of patients who were not treated with antibiotics but whom physicians thought could have been cured. For three quarters of these patients, the expectation was for only partial cure. We did not specify this, but the physicians may have feared these patients would be cured of the pneumonia at the cost of a decreased general condition. The occurrence of a pneumonia may have been used as an opportunity to let the patient die a natural death. The pneumonia may have been seen as "the old man's friend."[49]

Information from the literature concerning the frequency of withholding antibiotics is limited. Earlier studies[13,47,50,51] indicated that antibiotics were withheld in a quarter to half of patients, but these studies were not nationwide and included less severe infections than pneumonia. One study[50] concerned a population with severe dementia that was similar to our study. Physicians in this specific US nursing home and the Netherlands apparently consider withholding antibiotic treatment in pneumonia patients with dementia as an option. In frail patients and, more specifically, in patients with severe dementia, the physicians may have been inclined to forgo the more technical solutions often associated with full curative treatment (intravenous antibiotics and simultaneous rehydration).[12] A nonaggressive strategy in our frail study population is also obvious from rare use of hospital transfer and procedures, such as blood tests, x-ray examinations, tube feeding, and rehydration.

On the other hand, when cure was a goal, this was not achieved in more than a quarter of the patients treated with antibiotics. In our study, typically oral amoxicillin was given. In most Dutch hospitals and nursing homes, amoxicillin is the first drug choice in case of unknown pathogens,[52] which is generally sufficient since antibiotic resistance is still not a major problem in the Netherlands.[53] Physicians were willing at times to start more invasive procedures in more severely ill patients. Parenteral antibiotics (mostly intramuscular) were used for more severely ill patients, although not for patients with more severe dementia (analyses not shown). This finding suggests that withholding antibiotic treatment was not merely because of, for example, problems with oral intake. In our study, withholding antibiotic treatment was mostly, but not always, accompanied by starting symptom relief. In pa-

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tients treated with antibiotics, treatment to relieve symptoms was started in only a few cases. Apparently, the integrated approach, as suggested by Morrison and Siu,[54] is not yet common practice. Antibiotics were sometimes (8%) given for palliative reasons. However, evidence of the palliative effects of antibiotics is lacking.[55]

A limitation of the present study is that we did not obtain direct information from physicians, families, or medical records about the basis for decisions that were made. Inferences about factors considered important in the decision are based on variables that distinguish those patients who did and did not receive antibiotics. However, lack of variation with respect to a variable is indirect evidence that it is not weighted significantly in decision making. Advanced care planning is common in many of the nursing homes we studied, and good practice includes reconsulting with the family in the acute situation, even if advanced care planning has taken place.[27] On the other hand, because the physicians did not know analyses on withholding treatment were to be performed, it is also a strength of the design because they were not pressured to exhibit socially desirable responses. Another limitation concerns the diagnosis of pneumonia, which was often made without laboratory or x-ray film confirmation. Besides a poor response to antibiotic treatment (for example, in case of viral pneumonia), mistaken pneumonia diagnosis in patients who in fact had chronic heart failure or pulmonary embolism may have played a role in the patient population. However, in studying physicians' decision making, their diagnosis is what is ultimately of relevance. Finally, a strength of the study is limited patient variation; patients being much the same makes it achievable to study decision making.

To our knowledge, this is the first large quantitative study in which predictors of withholding antibiotic treatment in daily practice are assessed. Our data may facilitate discussions on whether the identified factors should really be important in the decision-making process and on discrepancies between expected and actual outcomes. Furthermore, they raise questions about how physicians should weigh patient factors in decision making on withholding antibiotic treatment. Explicitly mentioning identified factors during advanced care planning might be indicated.

We expect that there are some international differences in importance attached to specific factors relating to treatment decisions. The factors we identified relate predominantly to the dementia severity and the acute illness. We suspect that similar factors would generally reflect current physicians' attitudes in industrialized countries. They form a starting point for the conceptualizing of guidelines. These predictors should be examined prospectively for clinical[2,3] but also for ethical relevance in making decisions. Furthermore, to promote openness and responsible decision making, it is helpful to have an ethical and legal framework for decision making on whether to withhold antibiotic treatment.[17,27] Having a practical guideline including all these aspects is useful when discussing antibiotic treatment options with the patient's family and also in advanced care planning. This should promote prudent end-of-life care in frail, elderly patients.

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