Special Article

EUTHANASIA AND PHYSICIAN-ASSISTED SUICIDE AMONG PATIENTS WITH AMYOTROPHIC LATERAL SCLEROSIS IN THE NETHERLANDS

JAN H. VELDINK, M.D., JOHN H.J. WOKKE, M.D., PH.D., GERRIT VAN DER WAL, M.D., PH.D., J.M.B. VIANNEY DE JONG, M.D., PH.D., AND LEONARD H. VAN DEN BERG, M.D., PH.D.

ABSTRACT

Background Amyotrophic lateral sclerosis (ALS) is a disease that causes progressive paralysis leading to respiratory failure. Patients with ALS may consider physician-assisted suicide. However, it is not known how many patients, if given the option, would actually decide to end their lives by physician-assisted suicide or euthanasia nor at what stage of the disease they would choose to do so.

Methods We identified physicians of 279 patients in the Netherlands with a diagnosis of ALS who died between 1994 and 1999. Physicians were asked to fill out a validated questionnaire about the end-of-life decisions that were made. Of 241 eligible physicians, 203 returned the questionnaire (84 percent).

Results Of the 203 patients, 35 (17 percent) chose euthanasia and died that way. An additional six patients (3 percent) died as a result of physician-assisted suicide. Patients to whom religion was important were less likely to have died as a result of euthanasia or physician-assisted suicide. The choice of euthanasia or physician-assisted suicide was not associated with any particular characteristics of the disease or of the patient's care, nor was it associated with income or educational level. Disability before death was significantly more severe in patients who died as a result of euthanasia than among those who died in other ways. Physician-assisted suicide appeared to occur somewhat earlier in the course of the disease than did euthanasia. An additional 48 patients (24 percent) received palliative treatment, which probably shortened their lives.

Conclusions In the Netherlands, we found that one in five patients with ALS died as a result of euthanasia or physician-assisted suicide. (N Engl J Med 2002; 346:1638-44.)

AMYOTROPHIC lateral sclerosis (ALS) is a devastating disease characterized by the progressive degeneration of motor neurons. ALS can begin at any time during adulthood, with a median age at onset in the mid-50s.[1] Initial manifestations include weakness of limbs or weakness in the bulbar region leading to abnormalities of speech and difficulties in swallowing. The patient eventually becomes paralyzed, and approximately 50 percent of patients die within three years after the onset of symptoms, usually as the result of respiratory failure.

Supportive care is still the best treatment available for patients with ALS. Treatment with riluzole, an inhibitor of glutamate release, prolongs survival by only three to six months without affecting the quality of life.[2] Patients often have depression, feelings of loss of control, and a sense of isolation.[3] In the terminal phase of ALS, dyspnea and anxiety develop and require adequate treatment.[4,5]

Death is usually caused by respiratory failure unless ventilatory support is provided. Approximately 4 percent of patients agree to undergo a tracheostomy for long-term mechanical ventilation.[6] Patients with ALS and their physicians may be confronted by end-of-life medical decisions, such as whether or not to withhold or withdraw life-sustaining therapy and whether or not to treat dyspnea or pain with opioids in high doses. Specialists in ALS do receive requests for physician-assisted death.[7] It is not known how many patients with ALS, given the option, would end their lives by physician-assisted suicide or euthanasia, nor at what stage of the disease they would choose to do so.

In 1994, the death by euthanasia of a patient with ALS in the Netherlands was broadcast widely on television. Concern was raised that euthanasia would be considered an alternative to palliative care.[8,9] In the Netherlands, euthanasia and assisted suicide are still illegal, but there is no punishment if they are performed by a physician and under strict conditions, including the presence of a voluntary and well-considered request, unbearable and hopeless suffering, and consultation with a second physician. Although the possibility of depression is a major consideration, referral to a psychiatrist is not mandatory.[10] Further-

From the Department of Neurology, University Medical Center, Utrecht, the Netherlands (J.H.V., J.H.J.W., L.H.B.); and the Department of Social Medicine and the Institute for Research in Extramural Medicine, Vrije Universiteit Medical Center (G.W.), and the Department of Neurology, Academic Medical Center (J.M.B.V.J.) — both in Amsterdam. Address reprint requests to Dr. van den Berg at the Department of Neurology, G.03.228, University Medical Center Utrecht, P.O. Box 85500, 3508 GA Utrecht, the Netherlands, or at l.h.vandenberg@neuro.azu.nl.

more, physicians are supposed to follow technical guidelines: for euthanasia, barbiturates are used to induce coma, followed by a neuromuscular blocking agent to cause death; for physician-assisted suicide, high doses of barbiturates are administered orally.[11] The legal climate in the Netherlands enabled us to examine the actual end-of-life medical decisions that were made by a cohort of patients with ALS who died.

METHODS

Study Population

In the university clinics of Utrecht and Amsterdam in the Netherlands — both national referral centers for patients with ALS — we identified 279 patients who had died between January 1, 1994, and December 31, 1998, as having had possible, probable, or definite ALS according to the criteria of the El Escorial World Federation of Neurology.[12] Retrospectively, we collected clinical data from medical records. Since the general practitioner is the coordinating physician in the Dutch health care system, we sent each patient's general practitioner a self-administered questionnaire and a letter explaining the purpose of the study. A procedure was devised to ensure that the physicians and the deceased patients would remain anonymous. After four months, a reminder letter including another copy of the questionnaire was sent to the physicians who had not responded.

A total of 38 general practitioners stated that they were unable to answer our questions because they had recently taken over the practice from a retired colleague or because the patient had moved before he or she died; exclusion of the patients in question left 241 patients who could be included in the study. Of the 62 general practitioners who reported that the patient had died in a hospice, nursing home, or hospital, 47 filled out the questionnaire themselves and 15 stated that more detailed information could be provided by physicians at the institution where the death occurred. Ten of the 15 questionnaires sent to physicians at those institutions were returned. In total, 203 of the 241 questionnaires were returned (84 percent). The remaining 38 physicians who did not respond were contacted by telephone and asked about their reasons for not participating. The reason that was given most frequently was lack of time. Nearly all questionnaires were completed carefully, and many contained additional information beyond what had been requested. The institutional ethics committee of the University Medical Center in Utrecht approved the study protocol.

Questionnaire

The questionnaire we used was based on one that had been used in 1990 and 1995 for nationwide surveys in the Netherlands concerning end-of-life medical decisions.[13,14] We added 16 disease-related and care-related items to the original questionnaire, which contained 24 items.

In order to classify the responses in terms of the types of end-of-life medical decisions that were made, we studied the respondents' answers to four questions: What did the physician do (or not do)? What was his or her intention in so doing? Was the physician's decision made at the request of the patient or after discussion with the patient? Was the patient competent and able to assess the situation adequately and make a decision about it?

In the questionnaires, we avoided the terms "euthanasia" and "physician-assisted suicide," because their connotations are too varied. Instead, we used wording that more closely described actual medical practice, permitting us to classify the answers in the categories defined here.[13-16] In a validation study, the classification of end-of-life medical decisions that was based on the responses given on the mailed questionnaires differed minimally from the classification that was based on the responses given in face-to-face interviews.[14]

Euthanasia was defined as the administration of drugs with the explicit intention of ending the patient's life, at the patient's explicit request. Physician-assisted suicide was defined as the prescription or supplying of drugs with the explicit intention of enabling the patient to end his or her own life. The alleviation of pain and symptoms by means of opioids was defined as the administration of doses large enough that the attending physician considered them to have a probable life-shortening effect. A decision not to treat was defined as the withholding or withdrawal of potentially life-prolonging treatment, although palliative treatments may have been given. If a general practitioner reported more than one end-of-life decision in a given case, only the most important decision was included in the analysis.[13-16] The decisions in order of decreasing importance were physician-assisted death, forgoing treatment with the explicit goal of shortening life, administration of opioids with probable life-shortening effect, and forgoing treatment that would probably prolong life.

Statistical Analysis

We used the chi-square test to determine the significance of differences between patients who had died as a result of euthanasia or physician-assisted suicide and those who had died by other means in terms of the distribution of categorical factors. Differences in ordinal or continuous variables were calculated with the use of the Mann–Whitney U test. Multiple logistic regression was used to determine which variables were independent predictors of physician-assisted death. Differences in survival time were calculated with Kaplan–Meier survival statistics. Cox regression analysis was used to identify independent prognostic factors. All tests were two-sided, and a P value of less than 0.05 was considered to indicate statistical significance.

TABLE 1. CHARACTERISTICS OF 203 PATIENTS WITH AMYOTROPHIC LATERAL SCLEROSIS (ALS).

CHARACTERISTIC	VALUE
Diagnosis — no. (%)	
Sporadic ALS	192 (95)
Familial ALS	11 (5)
Age at onset — yr	
Median	59
Range	25–81
Sex — no. (%)	
Male	119 (59)
Female	84 (41)
Site of onset — no. (%)	
Spinal region	141 (69)
Bulbar region	62 (31)
El Escorial classification at time of diagnosis — no. (%)*	
Definite	41 (20)
Probable	96 (47)
Possible	40 (20)
Unknown	26 (13)
Survival time — yr	
Median	2.4
Range	0.5–10.1
Tracheostomy — no. (%)	7 (3)
Noninvasive ventilatory support — no. (%)	33 (16)

*Classification was according to the criteria of the El Escorial World Federation of Neurology.[12]

RESULTS

Characteristics of the Patients

The characteristics of the 203 patients with ALS who were included in our study are summarized in Table 1. This sample was representative of the general population with ALS in terms of the age at onset, sex, the duration of disease, the site of onset (spinal or bulbar region), and the presence or absence of both upper- and lower-motor-neuron signs.[1,17] The characteristics of the 76 patients who could not be included in the analysis did not differ significantly from those of the study cohort.

End-of-Life Decisions

End-of-life decisions were made in 112 of the 203 cases (55 percent) (Table 2). In the other 91 cases, no end-of-life decisions were made; in 37 of those cases (18 percent of the total), such decisions could not be made because the patients died suddenly. A total of 35 patients (17 percent) decided on euthanasia, and 6 patients (3 percent) decided on physician-assisted suicide. In all cases, euthanasia was performed by a physician.

In two cases, life was ended by the physician's actions without an explicit request from the patient. One of these patients was a 53-year-old married woman confined to bed who unexpectedly had trismus with bleeding of the jaw and choking. The other patient was a 54-year-old married woman confined to bed in whom pneumonia and sepsis led to unconsciousness and dyspnea. Both patients were unconscious at the time their life was ended. A previous request had been made by the latter patient, but decision making was ongoing in the case of the former patient; because of the circumstances, a concurrent explicit request could not be made in either case.

TABLE 2. END-OF-LIFE MEDICAL DECISIONS BY 203 PATIENTS WITH AMYOTROPHIC LATERAL SCLEROSIS.*

VARIABLE	NO. OF PATIENTS	PERCENTAGE OF PATIENTS (95% CI)
Unexpected sudden death	37	18 (13–24)
No end-of-life medical decision made	54	27 (21–33)
End-of-life medical decision made		
Any	112	55 (48–62)
Euthanasia	35	17 (12–22)
Physician-assisted suicide	6	3 (1–5)
Ending of life without patient's explicit request	2	1 (0–2)
Alleviation of pain and symptoms by medication in doses with a probable life-shortening effect	48	24 (18–29)
Forgoing treatment	21	10 (6–15)

*CI denotes confidence interval.

In an additional 48 cases (24 percent), the physicians reported that symptoms were treated with doses of medication that probably shortened the patient's life. In 21 cases (10 percent), a decision to forgo treatment was made. Treatments that were forgone included the treatment of pneumonia with antibiotics in 11 of the 21 patients, enteral feeding in 9 patients, and cardiopulmonary resuscitation in 1 patient. In 74 cases (36 percent), it was reported that there was an advance directive indicating the desire for physician-assisted death. Of the 33 patients whose requests for physician-assisted death were not granted, 11 received opioids in doses with a probable life-shortening effect, 9 acquired pneumonia that was not treated with antibiotics, and 13 died by other means, including 9 who died unexpectedly and suddenly.

Correlates of Physician-Assisted Death

We compared the group that chose physician-assisted death with the group that did not in terms of characteristics of the disease, of care, of the patient, and of the physician, as well as the circumstances surrounding death (Table 3). In this analysis, we excluded cases in which no end-of-life decision could be made because of sudden death.[15,16] The choice of physician-assisted death was positively associated with dying at home and negatively associated with importance placed on religion and the presence of feelings of anxiety before death (Table 3). According to multiple logistic-regression analysis, these associations were independent. None of the disease-related or care-related characteristics were associated with the choice of physician-assisted death, nor was income or educational level. The frequency of feelings of pain, despair, fear, choking, and anger were judged to be similar in the two groups of patients, which were also similar in terms of the frequency of feeding tubes, the proportion who had children, and the religion of the physician. Physician-assisted death was classified as peaceful in 93 percent of cases.

Stage of Disease and Physician-Assisted Death

We estimated the stage of the disease at the time of physician-assisted death by comparing patients who died by euthanasia, those who died by physician-assisted suicide, and those who died of other causes in terms of survival time (from the onset of disease) and degree of disability (use of arms, legs, and speech) (Table 4). Survival time did not vary significantly among the three groups (2.6 years, 2.8 years, and 2.4 years, respectively). A Cox regression analysis of survival time in which the site of onset, sex, age at onset, and use or nonuse of physician-assisted death were used as covariates showed that only the age at onset was an independent prognostic factor ($P=0.002$). Loss of function in the arms had been more severe in patients who

TABLE 3. CHARACTERISTICS OF 166 PATIENTS WITH AMYOTROPHIC LATERAL SCLEROSIS ACCORDING TO THE MEANS OF DEATH.*

CHARACTERISTIC	PATIENTS WHO DIED WITHOUT EUTHANASIA OR PHYSICIAN-ASSISTED SUICIDE (N=125)†	PATIENTS WHO DIED BY EUTHANASIA OR PHYSICIAN-ASSISTED SUICIDE (N=41)	P VALUE
Age at onset — yr			0.91
Median	59	59	
Range	25–81	37–75	
Sex — no. (%)			0.11
Male	73 (58)	18 (44)	
Female	52 (42)	23 (56)	
Site of onset — no. (%)			0.72
Spinal region	89 (71)	28 (68)	
Bulbar region	36 (29)	13 (32)	
Type of care — no. (%)			0.30
Professional	34 (27)	8 (20)	
Nonprofessional	89 (71)	33 (80)	
Unknown	2 (2)	0	
Marital status — no. (%)			0.28
Single	13 (10)	7 (17)	
Married or cohabiting	111 (89)	34 (83)	
Unknown	1 (1)	0	
Education — no. (%)			0.36
0–6 yr	12 (10)	2 (5)	
7–12 yr	54 (43)	15 (37)	
>12 yr	42 (34)	18 (44)	
Unknown	17 (14)	6 (15)	
Income — no. (%)			0.43
Low	10 (8)	2 (5)	
Average	60 (48)	17 (41)	
High	52 (42)	22 (54)	
Unknown	3 (2)	0	
Religion important to patient — no. (%)			0.005
Yes	65 (52)	13 (32)	
No	28 (22)	18 (44)	
Unknown	32 (26)	10 (24)	
Influenced by physician's religion — no. (%)			0.27
Yes	13 (10)	7 (17)	
No	109 (87)	32 (78)	
Unknown	3 (2)	2 (5)	
Place of death — no. (%)			0.003
Home	83 (66)	38 (93)	
Hospital	23 (18)	0	
Hospice or nursing home	19 (15)	3 (7)	
Feelings of anxiety — no. (%)			0.002
Yes	36 (29)	4 (10)	
No	59 (47)	34 (83)	
Unknown	30 (24)	3 (7)	
Peaceful death — no. (%)			1.00
Yes	109 (87)	38 (93)	
No	8 (6)	2 (5)	
Unknown	8 (6)	1 (2)	

*For categorical data, P values were calculated by chi-square tests comparing the distribution among patients who died by euthanasia or physician-assisted suicide with the distribution among those who did not. Patients with unknown values were not included in the chi-square analyses. For two-by-two tables, Fisher's exact test was used when cells had an expected frequency of less than five. Because of rounding, not all percentages total 100.

†Data are for cases in which it was possible to make end-of-life decisions; all 37 cases of unexpected death are excluded.

TABLE 4. STAGE OF DISEASE IN PATIENTS WITH AMYOTROPHIC LATERAL SCLEROSIS IN RELATION TO MEANS OF DEATH.*

CHARACTERISTIC	PATIENTS WHO DIED WITHOUT EUTHANASIA OR PHYSICIAN-ASSISTED SUICIDE (N=125)†	PATIENTS WHO DIED BY EUTHANASIA (N=35)	P VALUE	PATIENTS WHO DIED BY PHYSICIAN-ASSISTED SUICIDE (N=6)	P VALUE
Survival time — yr			0.35		0.95
Median	2.4	2.6		2.8	
Range	0.5–9.4	0.5–5.9		1.2–5.1	
Leg-related disability — no. (%)			0.50		0.18
Able to walk unsupported	4 (3)	1 (3)		2 (33)	
Unable to walk unsupported	22 (18)	3 (9)		0	
Dependent on wheelchair	28 (22)	10 (29)		2 (33)	
Confined to bed	70 (56)	21 (60)		2 (33)	
Unknown	1 (1)	0		0	
Arm-related disability — no. (%)			0.01		0.15
Able to raise arms to mouth and farther	48 (38)	6 (17)		4 (67)	
Able to raise arms but unable to reach mouth	42 (34)	14 (40)		2 (33)	
Paralysis	25 (20)	12 (34)		0	
Unknown	10 (8)	3 (9)		0	
Communication-related disability — no. (%)			0.52		0.69
Able to speak	66 (53)	16 (46)		4 (67)	
Able to communicate by other means	58 (46)	18 (51)		2 (33)	
Unknown	1 (1)	1 (3)		0	
Estimated amount of time by which life was shortened by end-of-life decision — no. (%)‡			0.49		<0.001
<1 mo	59 (83)	29 (83)		1 (17)	
1–6 mo	5 (7)	4 (11)		2 (33)	
>6 mo	0	0		3 (50)	
Unknown	7 (10)	2 (6)		0	

*P values are for the comparison with the group that died without euthanasia or physician-assisted suicide and were calculated by the Mann–Whitney test. Patients with unknown values were not included in the analysis. Because of rounding, not all percentages total 100.

†Data are for cases in which it was possible to make end-of-life decisions; all 37 cases of unexpected death are excluded.

‡Data are for cases in which an end-of-life decision was made. In the group that died by means other than euthanasia or physician-assisted suicide, decisions were made in 71 cases regarding forgoing treatment, the use of symptomatic treatment with probable life-shortening effects, or ending the patient's life without a concurrent explicit request by the patient.

died as a result of euthanasia. Functioning of legs and ability to speak had been similar in all patients.

We also studied the physicians' estimates of the amount of time by which life had been shortened in the patients who died as a result of an end-of-life medical decision (Table 4). For the majority of patients who died as a result of euthanasia (83 percent) or as a result of end-of-life decisions other than euthanasia or physician-assisted suicide (83 percent), life was estimated to have been shortened by less than one month. However, in five of the six patients who died as a result of physician-assisted suicide, it was estimated that life was shortened by more than one month.

DISCUSSION

In our study, about one in five patients with ALS died as a result of euthanasia (17 percent) or physician-assisted suicide (3 percent). Physician-assisted death was not associated with any of the disease-related or care-related characteristics, nor with income or educational level. These deaths were classified as peaceful by physicians in 93 percent of the cases. Comparison of survival time, degree of disability, and estimated amount of time by which life was shortened indicated that the disease was at an advanced stage in patients who died as a result of euthanasia but that physician-assisted suicide occurred earlier in the course of the disease. Of all 203 patients, 74 (36 percent) had given an advance directive indicating a desire for physician-assisted death.

Why did such a large proportion of patients with ALS consider physician-assisted death and actually die as a result of such a decision? Although the estimated frequency of physician-assisted death in the Nether-

lands is 2.7 percent,[15] the rate among patients with cancer is 10 percent and the rate among patients with the acquired immunodeficiency syndrome is 22 percent.[15,18] In the United States, 56 percent of patients with ALS in Oregon said they would consider assisted suicide, and 44 percent said they would request a prescription for a lethal dose of medication from a physician if it became a legal option.[4]

In our study, physicians estimated that patients who died as a result of euthanasia or physician-assisted suicide were similar to patients who died from other causes in terms of the receipt of hospice care and professional home care and the frequency of feelings of pain, despair, fear, choking, and anger. Therefore, neither these factors nor the patient's income or educational level could explain the physician-assisted deaths. The primary reasons that were reported for requesting physician-assisted suicide in Oregon included loss of independence and desire to control the circumstances of death.[19] Patients with ALS may consider having control over their death especially important, since their inability to work, engage in pleasurable activities, care for themselves, and communicate constitutes a formidable loss of autonomy[4]; having control over dying could be a means of limiting the sense of loss of self.[20] These determinants of the desire for physician-assisted death deserve further research and have implications for palliative care.

Patients to whom religion was important were less likely to choose to end their lives by euthanasia or assisted suicide — a finding that is consistent with those of previous studies. More religious patients with ALS are less likely to support the hastening of death,[4] and the religious beliefs of patients with ALS appear to influence important treatment decisions.[21]

Some shortcomings and limitations of our study should be noted. Our results may be valid only in the context of Dutch culture and law and a health care system in which virtually all of the population is insured for the cost of health care. Economic motives have not yet entered the realm of end-of-life decision making, even decisions regarding the use of artificial ventilation at home. Physicians who perform euthanasia or assist in suicide in the Netherlands are not prosecuted if the act has been carried out under strict legal conditions.[15] However, nationwide studies in other countries indicate that physician-assisted death occurs with a frequency similar to that found in the Netherlands.[16,17] Furthermore, our study may have been subject to selection bias, because the patients involved had been referred to our university clinics. Nevertheless, our cohort of patients was representative of the general population of patients with ALS.[1,13] The effects of information bias and recall bias cannot be ruled out, since the characteristics of many patients were reported by physicians, some of whom were reporting events that had occurred several years previously. Moreover, physicians might be reluctant to report that they had substantially shortened a patient's life. On the other hand, the fact that 84 percent of the physicians we contacted responded indicates that the majority of physicians in the Netherlands are prepared to invest substantial time in participating in studies of this type.

Apparently, the choice of euthanasia was made when the patient's disease was at an advanced stage, and physician-assisted suicide occurred earlier in the course of the disease. One would expect patients with ALS who die by physician-assisted suicide to have a lower degree of handicap than those who die by euthanasia, given that they have to be physically capable of taking the lethal drugs themselves.[4] Our results do not suggest that greater-than-average suffering or a lack of palliative care contributed to decisions to seek physician-assisted death. However, prospective research is needed to examine possible relations among palliative care, the role of the physician, the quality of life, the motives of the patient, and end-of-life medical decisions by patients with ALS.

Supported by a grant from the Netherlands Organization for Health Research and Development and by a fellowship (to Dr. van den Berg) from the Royal Netherlands Academy of Arts and Sciences.

REFERENCES

1. Traynor BJ, Codd MB, Corr B, Forde C, Frost E, Hardiman O. Incidence and prevalence of ALS in Ireland, 1995-1997: a population-based study. Neurology 1999;52:504-9.
2. Lacomblez L, Bensimon G, Leigh PN, et al. A confirmatory dose-ranging study of riluzole in ALS. Neurology 1996;47:Suppl 4:S242-S250.
3. Ganzini L, Johnston WS, McFarland HB, Tolle SW, Lee MA. Attitudes of patients with amyotrophic lateral sclerosis and their care givers toward assisted suicide. N Engl J Med 1998;339:967-73.
4. Miller RG, Rosenberg JA, Gelinas DF, et al. The care of the patient with amyotrophic lateral sclerosis (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology. Neurology 1999;52:1311-23.
5. Voltz R, Borasio GD. Palliative therapy in the terminal stage of neurological disease. J Neurol 1997;244:Suppl 4:S2-S10.
6. Albert SM, Murphy PL, Del Bene ML, Rowland LP. Prospective study of palliative care in ALS: choice, timing, outcomes. J Neurol Sci 1999;169:108-13.
7. Carver AC, Vickrey BG, Bernat JL, Keran C, Ringel SP, Foley KM. End-of-life care: a survey of US neurologists' attitudes, behavior, and knowledge. Neurology 1999;53:284-93.
8. Hendin H, Rutenfrans C, Zylicz Z. Physician-assisted suicide and euthanasia in the Netherlands: lessons from the Dutch. JAMA 1997;277:1720-2.
9. Jochemsen H, Keown J. Voluntary euthanasia under control? Further empirical evidence from the Netherlands. J Med Ethics 1999;25:16-21.
10. Bannink M, Van Gool AR, van der Heide A, van der Maas PJ. Psychiatric consultation and quality of decision making in euthanasia. Lancet 2000;356:2067-8.
11. Horikx A, Admiraal PV. Toepassing van euthanatica: ervaringen van artsen bij 227 patiënten, 1998-2000. Ned Tijdschr Geneeskd 2000;144:2497-500.
12. Brooks BR. El Escorial World Federation of Neurology criteria for the diagnosis of amyotrophic lateral sclerosis. J Neurol Sci 1994;124:Suppl:96-107.
13. van der Maas PJ, van Delden JJM, Pijnenborg L, Looman CWN. Euthanasia and other medical decisions concerning the end of life. Lancet North Am Ed 1991;338:669-74.

14. van der Maas PJ, van der Wal G, Haverkate I, et al. Euthanasia, physician-assisted suicide, and other medical practices involving the end of life in the Netherlands, 1990–1995. N Engl J Med 1996;335:1699-705.
15. Deliens L, Mortier F, Bilsen J, et al. End-of-life decisions in medical practice in Flanders, Belgium: a nationwide survey. Lancet 2000;356:1806-11.
16. Kuhse H, Singer P, Baume P, Clark M, Rickard M. End-of-life decisions in Australian medical practice. Med J Aust 1997;166:191-6.
17. Haverkamp LJ, Appel V, Appel SH. Natural history of amyotrophic lateral sclerosis in a database population: validation of a scoring system and a model for survival prediction. Brain 1995;118:707-19.
18. Bindels PJ, Krol A, van Ameijden E, et al. Euthanasia and physician-assisted suicide in homosexual men with AIDS. Lancet North Am Ed 1996;347:499-504.
19. Ganzini L, Nelson HD, Schmidt TA, Kraemer DF, Delorit MA, Lee MA. Physicians' experiences with the Oregon Death with Dignity Act. N Engl J Med 2000;342:557-63. [Erratum, N Engl J Med 2000;342: 1538.]
20. Lavery JV, Boyle J, Dickens BM, Maclean H, Singer PA. Origins of the desire for euthanasia and assisted suicide in people with HIV-1 or AIDS: a qualitative study. Lancet 2001;358:362-7.
21. Murphy PL, Albert SM, Weber CM, Del Bene ML, Rowland LP. Impact of spirituality and religiousness on outcomes in patients with ALS. Neurology 2000;55:1581-4.