Patient Age and Decisions To Withhold Life-Sustaining Treatments from Seriously Ill, Hospitalized Adults

Mary Beth Hamel, MD, MPH; Joan M. Teno, MD, MS; Lee Goldman, MD, MPH; Joanne Lynn, MD, MA; Roger B. Davis, ScD; Anthony N. Galanos, MD; Norman Desbiens, MD; Alfred F. Connors Jr., MD; Neil Wenger, MD, MPH; and Russell S. Phillips, MD, for the SUPPORT Investigators

Background: Patient age may influence decisions to withhold life-sustaining treatments, independent of patients' preferences for or ability to benefit from such treatments. Controversy exists about the appropriateness of using age as a criterion for making treatment decisions.

Objective: To determine the effect of age on decisions to withhold life-sustaining therapies.

Design: Prospective cohort study.

Setting: Five medical centers participating in the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT).

Patients: 9105 hospitalized adults who had one of nine illnesses associated with an average 6-month mortality rate of 50%.

Measurements: Outcomes were the presence and timing of decisions to withhold ventilator support, surgery, and dialysis. Adjustment was made for sociodemographic characteristics, prognoses, baseline function, patients' preferences for life-extending care, and physicians' understanding of patients' preferences for life-extending care.

Results: The median patient age was 63 years; 44% of patients were women, and 53% survived to 180 days. In adjusted analyses, older age was associated with higher rates of withholding each of the three life-sustaining treatments studied. For ventilator support, the rate of decisions to withhold therapy increased 15% with each decade of age (hazard ratio, 1.15 [95% CI, 1.12 to 1.19]); for surgery, the increase per decade was 19% (hazard ratio, 1.19 [CI, 1.12 to 1.27]); and for dialysis, the increase per decade was 12% (hazard ratio, 1.12 [CI, 1.06 to 1.19]). Physicians underestimated older patients' preferences for life-extending care; adjustment for this underestimation resulted in an attenuation of the association between age and decisions to withhold treatments.

Conclusion: Even after adjustment for differences in patients' prognoses and preferences, older age was associated with higher rates of decisions to withhold ventilator support, surgery, and dialysis.

This paper is also available at http://www.acponline.org.

Ann Intern Med. 1999;130:116-125.

From Beth Israel Deaconess Medical Center, Boston, Massachusetts; Brown University, Providence, Rhode Island; University of California, San Francisco, School of Medicine, San Francisco, California; George Washington University, Washington, D.C.; Duke University Medical Center, Durham, North Carolina; University of Tennessee College of Medicine, Chattanooga, Tennessee; University of Virginia School of Medicine, Charlottesville, Virginia; and University of California, Los Angeles, School of Medicine, Los Angeles, California. For current author addresses, see end of text.

For patients hospitalized with serious illness, decisions about the use of invasive, life-sustaining treatments are medically and ethically complex (1–3). Previous research suggests that treatment decisions may be based on patient age, independent of medical appropriateness or patients' preferences (4, 5). We previously demonstrated that seriously ill elderly patients receive fewer procedures and less expensive hospital care than younger patients with similar illnesses. This preferential allocation of hospital services to younger patients does not seem to be driven by differences in patients' preferences for life-extending care or illness characteristics (4). Higher rates of withholding life-sustaining treatments from elderly persons could contribute to these observed differences in resource use.

Controversy exists about whether patient age is an acceptable criterion on which to base decisions about use of health care resources. Some researchers have argued that withholding beneficial treatments from elderly patients to make more health care resources available to younger patients is rational and inherently fair (6–10). Others have argued that age is an inappropriate and arbitrary criterion by which to allocate health care resources and that treatment decisions should be based on a patient's ability to benefit (11–14).

We studied 9105 seriously ill patients to evaluate how patient age, independent of patients' objective prognoses and preferences for life-extending care, influences physicians' decisions to withhold life-sustaining therapies.

Methods

Study Design

The study group consisted of patients enrolled in the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT), a study of preferences, decision making, and outcomes for patients hospitalized at one of five geographically diverse academic medical centers. A full description of the methods and objectives of this study has been published elsewhere (15, 16). Patients were screened for eligibility at hospital admission; patients in intensive care units were also

screened daily. Patients were enrolled if they were 18 years of age or older and met illness severity criteria for at least one of nine diagnostic categories: acute respiratory failure, chronic obstructive lung disease, congestive heart failure, cirrhosis, nontraumatic coma, metastatic colon cancer, advanced lung cancer, multiple organ system failure with sepsis, or multiple organ system failure with malignancy. Diagnostic criteria were designed so that patients would have, on average, a 50% probability of surviving for 6 months. Eligible patients who died or were discharged within 48 hours were excluded.

On the basis of problems in care identified during the observational portion of the study, phase I (enrollment from June 1989 through June 1991), an intervention was developed and implemented during phase II (enrollment from January 1992 through January 1994). Clinicians of patients who were randomly assigned to the intervention group received information about their patients' preferences and prognoses and were assigned clinical nurse-specialists to facilitate symptom control and communication with their patients. The study design was approved by the institutional review board at each medical center, and informed consent was obtained before patients were interviewed. Because no differences in targeted outcomes were observed between the intervention group and the control group in phase II or between phase I and phase II patients (16), we combined phase I and phase II patients for these analyses.

Data Collection

Data were collected daily from paper and electronic medical records and from interviews with patients and their surrogates (defined as persons who would make care decisions if patients were unable to do so). Patients were excluded from interviews if they could not communicate because of such reasons as intubation, coma, or cognitive impairment.

Abstractors of medical records gathered information, including diagnoses, comorbid conditions, and acute physiology data that were included in the Acute Physiology and Chronic Health Evaluation (APACHE) III prognostic system (17). In addition, abstractors collected information on the presence and timing of discussions and decisions about use of ventilators, surgery, dialysis, blood transfusions, vasopressors, organ transplantation, tube feeding, cardiopulmonary resuscitation, and treatment in intensive care units. Surgery was defined as a procedure that took place in the operating room.

Between study days 2 and 6, interviewers questioned patients and their surrogates about patients' sociodemographic characteristics, functional and activity status before hospital admission (using a modified version of the Katz activities of daily living scale [18, 19] and the Duke Activity Status Index [20, 21]), preferences for cardiopulmonary resuscitation in the event of cardiac arrest, and preferences for care aimed at extending life. The exact wording of questions about patients' care preferences is shown in the Appendix.

Between study days 2 and 6, interviewers asked physicians about their patients' preferences for cardiopulmonary resuscitation and life-extending care and about the physicians' own preferences if they were in their patients' situations. The latter question was asked only during phase I of the study.

Statistical Analysis

We focused our analyses on decisions to withhold three life-sustaining treatments (dependent variables): ventilator support, surgery, and dialysis. The presence of a decision to withhold a life-sustaining treatment was defined as chart documentation of the decision to withhold the treatment if the patient's condition required such a treatment to sustain life. We analyzed these three treatments because they are invasive, expensive, and commonly used in clinical practice and were discussed often enough to make analyses feasible.

We used descriptive statistics to characterize the entire study sample and the subgroup of patients for whom one or more decisions were made to withhold one of the life-sustaining treatments studied. We analyzed age as a continuous variable and as a categorical variable. In analyses of age as a continuous variable, we examined age as a simple linear predictor. In addition, we used cubic spline functions (22) to avoid the assumption of linearity between age and the timing of decisions to withhold treatments. For analyses that examined age as a categorical variable, we divided patients into five age groups on the basis of decades of life and the age distribution of the sample ($<$50 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, and $\geq$80 years). We restricted all bivariable and multivariable analyses of each treatment to the subgroup of patients for whom the treatment issue arose at some point during the index hospitalization (defined as medical record documentation of discussion with the patient and family, discussion among hospital staff, or documentation of a note or order regarding the treatment). We used chi-square tests for trend in our bivariable comparisons between patient age group and decisions to withhold a life-sustaining treatment at some point during the index hospitalization.

To adjust for potential confounding factors, we performed multivariable analyses using Cox proportional hazards models; we analyzed time from study admission to the day of first chart documentation of a decision to withhold a particular life-sustaining

treatment if the patient's medical condition required such a treatment to sustain life. Patients were censored when they died or were discharged from the hospital.

We adjusted for sex, ethnicity, income, insurance, education, study site, number of days hospitalized before study admission, baseline functional status, number of comorbid conditions, the presence of cancer or dementia as a baseline comorbid condition, an objective estimate of 2-month survival made on study day 3 by using the SUPPORT prognostic model (23), and the patients' preferences for cardiopulmonary resuscitation and life-extending care between study days 3 and 6. For these multivariable analyses, "do not know" responses were classified with "yes" responses because cardiopulmonary resuscitation is typically provided unless patients state a clear preference to forgo this treatment. When patient interview data were not available, surrogates' perceptions of patients' preferences were substituted, as is done in clinical practice. Patients for whom preference data were not available from patients or surrogates could not be included in these primary analyses. The SUPPORT prognostic model based estimates of survival on 11 physiologic measures recorded on study day 3, diagnosis, age, number of days in the hospital before study entry, presence of cancer, and neurologic function. Because the SUPPORT model includes age in its survival estimates, we could adjust for the independent effect of age on survival by including SUPPORT prognostic estimates in our multivariable models.

In our multivariable analyses of age as a simple continuous variable, we calculated adjusted hazard ratios (and corresponding 95% CIs) associated with each decade increase in age for decisions to withhold ventilator support, dialysis, and surgery. From the Cox proportional hazard models containing age as a continuous variable represented by using cubic spline functions, we plotted the adjusted probability of a decision to withhold each life-sustaining therapy by study day 30 against patient age. We obtained model-based estimates of time-to-event curves (24, 25) for a "typical" SUPPORT patient (that is, using modal or median values for covariates other than age) at ages ranging from 18 to 100 years. From each of these curves, we selected the estimated probability at day 30. From the models containing age groups, we computed adjusted relative risk (hazard ratios) for decisions to withhold treatments and corresponding 95% CIs in comparisons of patients in each older age group with patients younger than 50 years of age.

In multivariable models, we explored potential interactions between patient age and study site and between diagnosis and functional status. In addition, we performed analyses adjusting for physician age, study phase (phase I compared with phase II), and whether patients received the life-sustaining intervention.

We used chi-square tests for trend to determine whether physicians' understanding of patients' preferences for life-extending care and physicians' own preferences for life-extending care if they were in their patients' situations differed according to patient age groups. To explore whether age-related differences in treatment decisions could be explained by age-related differences in physicians' understanding of patients' preferences, we adjusted for physicians' reports of patients' preferences in multivariable models.

Results

Patient Characteristics

Table 1 shows the characteristics of the 9105 patients in the entire SUPPORT cohort and of the subgroup for whom a life-sustaining treatment issue arose during the index hospitalization. For these latter patients, **Table 1** also compares patients 70 years of age and older with those younger than 70 years of age. Older patients had worse survival and function and were less likely to want life-extending care.

Decisions To Withhold Life-Sustaining Treatments

Among patients for whom each treatment issue arose, decisions were made to withhold ventilator support for 30% (1600 of 5371), to withhold surgery for 13% (375 of 2982), and to withhold dialysis for 29% (380 of 1298).

Older Age and Decisions To Withhold Treatment

In unadjusted analyses, decisions to withhold each life-sustaining treatment were more common in older age groups (**Table 2**). After adjustment for other sociodemographic characteristics, baseline function, comorbid conditions, prognosis, and preferences for cardiopulmonary resuscitation and life-extending care, the association between older age and increased rates of decisions to withhold treatments persisted. In analyses examining age as a simple continuous variable, older age was associated with higher rates of withholding each of the three life-sustaining treatments studied. For ventilator support, the rate of decisions to withhold treatment increased 15% with each decade of age (hazard ratio, 1.15 [95% CI, 1.12 to 1.19]); for surgery, the increase per decade was 19% (hazard ratio, 1.19 [CI, 1.12 to 1.27]); and for dialysis, the increase per decade was 12% (hazard ratio, 1.12 [CI, 1.06 to 1.19]). As illustrated in **Table 3** and the **Figure**, the

Table 1. Patient Characteristics*

Characteristic	All SUPPORT Patients (n = 9105)	Patients for Whom a Life-Sustaining Treatment Issue Arose during Index Hospitalization†		
		All Ages (n = 6185)	Age < 70 Years (n = 3922)	Age ≥ 70 Years (n = 2263)
Mean age ± SD, *y*	63 ± 16	62 ± 16	53 ± 13	78 ± 6
Age distribution, *n (%)*				
<50 years	1896 (21)	1386 (22)		
50–59 years	1577 (17)	983 (16)		
60–69 years	2387 (26)	1553 (25)		
70–79 years	2199 (24)	1539 (25)		
≥80 years	1046 (12)	724 (12)		
Women, %	44	45	43	48
Ethnicity, %				
White	79	79	75	86
Black	15	15	18	11
Other	5	6	7	3
Diagnoses, %				
Acute respiratory failure or multiple organ system failure with sepsis	39	51	51	50
Congestive heart failure	15	8	7	11
Chronic obstructive lung disease	11	10	7	14
Advanced lung cancer	10	4	5	3
Multiple organ failure with malignancy	8	9	11	7
Nontraumatic coma	7	9	8	10
Metastatic colon cancer	6	4	5	3
Cirrhosis	6	4	6	1
Comorbid conditions, *n*				
Mean comorbid conditions ± SD, *n*	1.9 ± 1.3	1.8 ± 1.4	1.7 ± 1.4	1.9 ± 1.3
Cancer, %	14	16	14	19
Dementia, %	3	4	1	8
Mean dependencies in activities of daily living ± SD, *n*	1.5 ± 1.4	1.6 ± 1.4	1.5 ± 1.4	1.8 ± 1.4
Patients who wanted CPR (n = 6332), %	67	66	73	53
Patients who wanted life-extending care (n = 6022), %	46	46	52	34
Mean probability of surviving 2 months (based on SUPPORT model) ± SD	0.64 ± 0.25	0.58 ± 0.26	0.61 ± 0.26	0.54 ± 0.25
Survival to hospital discharge, %	74	64	65	61
Survival to 6 months, %	53	48	51	41
Mean length of hospital stay ± SD, *d*	20 ± 25	26 ± 29	27 ± 31	22 ± 25

* For all comparisons between patients <70 and ≥70 years of age, $P < 0.001$. CPR = cardiopulmonary resuscitation; SUPPORT = Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments.

† Defined as documentation in the medical record of discussion with patient or family or among hospital staff about the use of surgery, ventilator support, or dialysis or presence of a note or order about using or withholding any of these treatments.

relation between age and decisions to withhold treatment differed across the three treatments. In adjusted analyses that examined age divided into five groups, the hazard ratios generally increased across the age groups. In analyses of ventilator support, when patients in older age groups were compared with patients younger than 50 years of age, rates of withholding treatment were 30% to 50% higher for patients 50 to 79 years of age (hazard ratios by decade, 1.4, 1.3, and 1.5) and 110% higher for patients 80 years of age and older (hazard ratio, 2.1). For major surgery, again comparing patients in older age groups (50 to ≥80 years of age) with patients younger than 50 years of age, the hazard ratios increased across the age groups; the smallest increase was between patients 70 to 79 years of age and those 80 years of age and older (hazard ratios by decade, 1.2, 1.4, 1.7, and 1.8). For dialysis, the adjusted hazard ratios increased for patients 60 to 69 years of age and patients 70 to 79 years of age (hazard ratio, 1.4) and increased further for patients 80 years of age and older (hazard ratio, 1.9). Analyses that did not include adjustment for patients' preferences, did not require exclusion of patients with missing interview data, and allowed for inclusion of all patients for whom each treatment issue arose yielded similar results.

In additional multivariable analyses, we found no significant relation between patient age and study site or between diagnosis and functional status. When we included physician age in our models, we found no significant relation between physician age and decisions to withhold treatments. In addition, when we adjusted for SUPPORT phase (observa-

Table 2. Patient Age and Decisions To Withhold Life-Sustaining Treatments*

Age	Decision Made To Withhold Treatment		
	Ventilator Support (n = 5371)	Major Surgery (n = 2982)	Dialysis (n = 1298)
y	← % (*n*/*n*) →		
<50	18 (219/1220)	7 (51/692)	23 (85/373)
50–59	27 (223/828)	9 (42/493)	21 (44/208)
60–69	29 (375/1313)	12 (97/791)	29 (95/328)
70–79	36 (483/1344)	17 (126/734)	38 (113/299)
≥80	45 (300/666)	22 (59/272)	48 (43/90)

* Data were obtained by using unadjusted analysis. For age differences for each treatment, $P < 0.001$.

Table 3. Patient Age and Decisions To Withhold Life-Sustaining Treatments*

Age, *y*	Relative Risk for Decision To Withhold Treatment (95% CI)†		
	Ventilator Support (*n* = 3972)	Major Surgery (*n* = 2262)	Dialysis (*n* = 913)
<50	–	–	–
50–59	1.4 (1.1–1.8)	1.2 (0.7–1.9)	0.9 (0.6–1.4)
60–69	1.3 (1.0–1.6)	1.4 (0.9–2.2)	1.4 (0.9–2.1)
70–79	1.5 (1.2–1.9)	1.7 (1.0–2.5)	1.4 (0.9–2.3)
≥80	2.1 (1.6–2.7)	1.8 (1.1–3.1)	1.9 (1.1–3.4)

* Data were adjusted for sex, ethnicity, income, level of education, insurance status, prognosis, comorbid conditions, baseline functional status, study site, and preference for cardiopulmonary resuscitation and life-extending care.
† Hazard ratio, comparing patients in each older age group with patients younger than 50 years of age.

tion compared with intervention) and for whether patients received the life-sustaining intervention, our results were similar. In analyses excluding patients who responded "do not know" to questions about their preferences for cardiopulmonary resuscitation or life-extending care, results were similar to results of our primary analyses.

Functional Status and Dementia and Decisions To Withhold Treatment

In unadjusted analyses, patients for whom decisions were made to withhold life-sustaining treatments had more dependencies in activities of daily living than other patients. The mean number of dependencies of daily living per treatment, comparing patients for whom decisions were made to withhold each life-sustaining treatment with those for whom no such decision was made, were as follows: ventilator, 1.9 compared with 1.5; surgery, 1.8 compared with 1.4; and dialysis, 1.8 compared with 1.6 ($P < 0.001$ for all comparisons). In multivariable analyses, however, number of dependencies of activities of daily living was not independently associated with decisions to withhold life-sustaining treatments (adjusted relative risk for ventilator, 1.05; for surgery, 1.02; and for dialysis, 1.02).

In unadjusted analyses, decisions to withhold life-sustaining treatments were more common among patients with dementia (ventilator, 50% compared with 29%; surgery, 27% compared with 12%; and dialysis, 54% compared with 29%) ($P < 0.01$ for all comparisons). In adjusted analyses, dementia was a significant independent correlate only for decisions to withhold dialysis (relative risk, 3.7 [95% CI, 1.1 to 12.7]).

Multivariable analyses suggested that functional status and the presence of dementia are not major confounders in the relation between age and decisions to withhold treatments. In unadjusted analysis, the risk for a decision to withhold ventilator support for patients 80 years of age and older was 3.5 times greater than that for patients younger than 50 years of age. After we adjusted for dependencies in activities of daily living and the presence of dementia, the relative risk modestly declined from 3.5 to 3.2 and remained highly significant.

Physicians' Preferences and Perceptions of Patients' Preferences

Of the 4556 patients who stated a preference about care (surrogates' responses were substituted when patients' responses were unavailable), 46% wanted care focused on extending life and 54% wanted care focused on comfort. Physicians stated that they did not know the preferences of 25% of their patients. Physicians' assessment of patients' preferences were correct for 45% of patients and incorrect for the remaining 31% (for 19%, the physician mistakenly believed that the patient wanted care focused on comfort, and for 12%, the physician mistakenly believed that the patient wanted care focused on prolonging life).

Older patients were less likely to want aggressive care than younger patients (**Table 4**). Physicians were less likely to think that patients wanted life-extending care when the patients were older; physicians were also less likely to want life-extending care for themselves if they were in an older patient's situation rather than in a younger patient's situation. For the 1564 patients with available interview data who wanted life-extending care, physicians were more likely to erroneously believe that patients did not want life-extending care when patients were older (physicians made this mistake 79% of the time for patients 80 years of age and older compared with 36% of the time for patients younger than 50 years of age).

We examined whether physicians' misperceptions

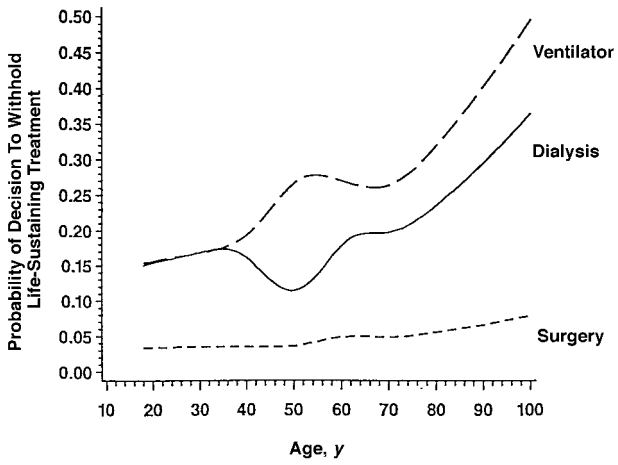

Figure. Relation between patient age and the adjusted probability of a decision to withhold each life-sustaining treatment by study day 30. Results are calculated on the basis of Cox proportional hazard models representing age as cubic spline functions and are adjusted for sex, income, education, insurance, prognosis, comorbid conditions, baseline function, study site, and preferences for cardiopulmonary resuscitation and life-extending care.

Table 4. Patient Age and Physicians' Preferences and Perceptions of Patients' Preferences for Life-Sustaining Treatment

Age	Patient Wants Life-Extending Care (n = 6022)†	Physician Would Want Life-Extending Care if in Patient's Situation (n = 3223)‡	Physician Thinks That Patient Wants Life-Extending Care (n = 4786)	For Patients Who Want Life-Extending Care, Physician Thinks That Patient Does Not (n = 1564)
y	← % (*n*/*n*) →			
<50	61 (772/1271)	48 (325/672)	60 (589/989)	36 (159/446)
50–59	52 (559/1085)	28 (158/558)	41 (327/798)	50 (156/310)
60–69	44 (695/1577)	26 (231/878)	34 (438/1278)	61 (239/391)
70–79	37 (535/1438)	20 (147/724)	25 (290/1178)	70 (222/318)
≥80	27 (177/651)	8 (33/391)	14 (76/543)	79 (78/99)

* Chi-square test for trend, $P = 0.001$.
† Surrogate responses were used when patients' responses were not available; "do not know" responses were not included.
‡ Asked only in phase I of the study.

of elderly patients' preferences for aggressive care contributed to the higher rates of decisions to withhold treatments for elderly patients. As discussed above, for patients who stated a desire for aggressive care, physicians were less likely to believe that patients wanted aggressive care when patients were older. In multivariable analyses that included adjustment for patients' preferences and for physicians' reports of patients' preferences for cardiopulmonary resuscitation and life-extending care, the age-related differences in decisions to withhold life-sustaining treatments were less pronounced than in analyses that did not include adjustment for physicians' reports of patients' preferences. Compared with patients 50 years of age or younger, patients 80 years of age and older had a relative risk of 2.3 (95% CI, 1.5 to 3.6) for a decision to withhold ventilator support when adjustment for physicians' reports of patients' preferences for cardiopulmonary resuscitation and life-extending care was not included; the relative risk was 1.6 (CI, 1.0 to 2.5) when this adjustment was included.

Patients 80 years of age and older had a relative risk of 2.3 (CI, 1.1 to 4.8) for a decision to withhold treatment when adjustment for physicians' beliefs about patients' preferences was not included and a relative risk of 1.8 (CI, 0.8 to 3.9) when this adjustment was included. Patients 80 years of age and older had a relative risk of 2.2 (CI, 0.9 to 5.2) for a decision to withhold treatment when adjustment for physicians' beliefs about patients' preferences was not included and a relative risk of 1.4 (CI, 0.6 to 3.5) when this adjustment was included. The fact that accounting for physicians' reports of patients' preferences resulted in an attenuation of the association between patient age and rates of decisions to withhold treatments suggests that physicians' underestimation of elderly patients' desire for aggressive care explains part of the age-related differences in rates of decisions to withhold life-sustaining treatments.

Discussion

Our results indicate that health care providers frequently decide to withhold life-sustaining treatments from seriously ill, hospitalized adults, especially elderly adults. Even after adjustment for patients' prognoses and preferences for cardiopulmonary resuscitation and life-extending care, older age was associated with higher rates of decisions to withhold ventilator support, surgery, and dialysis. We found that physicians' tendency to underestimate elderly patients' desire for aggressive treatments explained part of these differences.

Our findings are consistent with those of several previous studies that examined practice patterns and resource allocation. Older patients with coronary artery disease were less likely to undergo invasive and noninvasive testing or to receive thrombolytic therapy (26–30). Patients 70 years of age and older with stage I and stage II breast cancer were less likely to receive appropriate interventions than patients 50 to 69 years of age (31). Previous SUPPORT analyses showed that, after adjustment for patients' prognoses and preferences, elderly patients were more likely than younger patients to have do-not-resuscitate orders and to receive fewer hospital resources (4, 32). Lubitz and Riley (33) showed that from 1976 to 1988, the pattern of lower Medicare payments for older decedents compared with younger decedents persisted. A 1995 analysis of Medicare expenses by Lubitz and colleagues (34) indicated that increased longevity will have little effect on overall Medicare costs because of decreased spending per additional year of life as the age at death increases.

Ageism, or discrimination solely on the basis of chronological age, is one explanation for our findings (35). Research from the 1960s and 1970s showed that many medical students were biased against elderly persons (36, 37). Physicians' decisions to withhold life-sustaining treatments from elderly patients may reflect society's values. In other

countries, such as the United Kingdom, chronological age is used as a criterion for rationing health care (38), and the public seems to support this practice. In a 1996 survey of 2005 adults in the United Kingdom, respondents gave "treatment for people aged 75 and over with life threatening illness" lowest priority when asked to rank 12 health care services. Rank 1 was given to "treatments for children with life threatening illness," rank 2 was given to "special care and pain relief for people who are dying," and rank 11 was given to "treatment for infertility" (39).

Rates of dialysis use are higher in the United States than in any European country; a 1983 analysis attributed about 50% of this variation to differences in the ethnic compositions of the populations and most of the remaining differences to European practices of limiting access to dialysis for elderly patients and patients with significant medical complications (40). Nephrologists from Canada, the United Kingdom, and the United States were surveyed to examine potential explanations for differences in use of dialysis among countries. When selecting patients for dialysis, U.S. nephrologists placed more importance on patient and family wishes than did Canadian and British nephrologists; Canadian and British nephrologists were more likely to base decisions on patients' quality of life than were U.S. nephrologists. Only 2% of U.S. nephrologists reported refusing patients dialysis because of lack of resources, compared with 10% of Canadian nephrologists and 12% of British nephrologists (41).

Our finding of an association between older age and higher rates of withholding dialysis, independent of patients' preferences for aggressive care, is somewhat inconsistent with findings from these European–American studies that suggest a relatively high rate of dialysis for the elderly and a strong emphasis on patients' and families' wishes in decision making about dialysis in the United States. Decisions about short-term use of dialysis for seriously ill patients may be different from decisions about use of dialysis for chronic renal failure. In addition, it is possible that if a study of seriously ill patients similar to SUPPORT was done in Europe, age-related differences in rates of withholding life-sustaining treatments would be even more pronounced than the differences we observed.

Another possibility is that physicians' decisions may reflect their own personal values and preferences. When the physicians participating in our study were asked what type of care they would want for themselves if they were in their patients' situations, physicians reported that they would want care focused on life extension 48% of the time when the patient was younger than 50 years of age but only 8% of the time when the patient was 80 years of age or older. Physicians' preferences and care decisions are based on more information about the potential benefits of life-sustaining treatments than is typically available to patients. In our comparison of patients' and physicians' assessments of patients' care preferences, we assumed that patients' reports of their preferences were accurate and that physicians were in error when their assessment differed from the patients' assessments. It is possible, however, that in some cases patients did not report their true preferences because they did not fully understand the questions or because their response was based on incomplete or inaccurate information. In a previous study of ambulatory elderly patients, providing patients with information about the probability of survival to hospital discharge after cardiac arrest reduced the percentage of patients who wanted cardiopulmonary resuscitation from 41% to 22% (42).

In addition, physicians may withhold life-sustaining treatments from older patients because they believe that older patients are less likely to respond to these treatments than younger patients. Another possible explanation for our findings is that rather than assessing each individual's health status and potential to benefit from treatment, physicians may use chronological age as a proxy for other characteristics associated with poorer prognosis, such as more comorbid conditions or severity of illness (43). Our data suggest that poorer functional status among elderly patients accounts for some of the unadjusted differences in rates of decisions to withhold life-sustaining treatments, but age-related differences persisted even after adjustment for dementia and dependencies in activities of daily living. Physicians were not systematically informed about patients' functional status and therefore may have systematically underestimated the functional status of elderly patients; this may have affected physicians' decision making. Physicians may withhold life-sustaining treatments from elderly patients because they do not view these treatments as cost-effective and may not know that selected invasive treatments have been shown to be cost-effective, even in very elderly patients (44). Furthermore, because elderly patients have an inherently shorter life expectancy and their quality of life is undervalued, treatment allocation based on cost-effectiveness principles favors younger patients (45).

Finally, another potential explanation of our findings is that although physicians see invasive treatments as futile for many seriously ill patients of all ages, they feel obligated to "do everything" for younger patients. As capitated reimbursement becomes more prevalent and pressures to reduce delivery of unnecessary care intensify, inappropriate delivery of ineffective medical care will probably

decline and result in a reduction of any existing tendency to overtreat younger patients. However, it is also likely that withholding potentially beneficial care will become more common. This could make elderly patients particularly vulnerable to reduced access to certain effective medical interventions.

Our study had several limitations. First, we could not determine whether these treatments were potentially beneficial to patients. We do not know whether providers were more likely to decide to withhold beneficial treatments from older patients than from younger patients or whether providers were more likely to give unnecessary or futile treatments to younger patients than to older patients. Second, we did not have information on patients' preferences for the specific treatments studied but rather used their preferences for cardiopulmonary resuscitation and the general category of life-extending care as proxies. In addition, patients' preferences for the life-sustaining treatments studied may have changed between the time of the interview and the time of decision making. As SUPPORT and other studies have shown, elderly patients are less likely than younger patients to want aggressive care (46, 47). More detailed information on patients' care preferences would have allowed us to adjust more fully for age-related differences in patients' desires for life-sustaining treatments.

Our results may also have been influenced by informative censoring; that is, the censoring mechanism might not have been independent of the risk for outcomes. Our time-to-event analyses required censoring of patients at the time of death and at the time of hospital discharge; the risk for decisions to withhold treatments might have changed as death or discharge approached. For example, decisions to withhold life-sustaining treatments might have been more likely to occur when patients became more ill and more likely to die. In addition, decisions to withhold life-sustaining treatments might have been less likely to occur when patients improved and became ready for discharge. Our analyses included adjustment for prognosis; this should have reduced the effect of this potential bias on our analyses. We have no reason to believe that informative censoring substantially influenced our finding of age-related differences in rates of decisions to withhold life-sustaining treatments. Furthermore, when we used logistic regression models to examine decisions made during the first 2 days of the study (when models were based on study inclusion and exclusion criteria, all patients were alive and hospitalized), our results were similar.

Our information about decisions to withhold life-sustaining treatments was collected from medical records. We did not have information about decisions that were made but not recorded in the medical record, and we may have failed to capture a substantial number of decisions to withhold life-sustaining treatments. We have no reason to believe, however, that this affected our finding of an association between age and increased rates of decisions to withhold treatments, because it is unlikely that older patient age is associated with more thorough documentation of decision making. We used study day 1 as the starting point for analyses of timing of decisions to withhold treatment; our study would have been stronger if we had had precise information on when each treatment decision was clinically relevant. This limitation had the potential to bias our results if age was associated with the time at which these treatment issues became clinically relevant.

We think that such a bias is unlikely for the following reasons. First, the inclusion and exclusion criteria for SUPPORT were designed such that from the time of study admission, patients were gravely ill and at high risk for complications and death. For most patients, decisions about various commonly used life-sustaining treatments (including ventilator support in the event of respiratory failure, dialysis in the event of renal failure, and surgery in the event of a complication requiring a surgical procedure) were relevant from the time that patients met SUPPORT criteria for serious illness. Second, when we repeated our analyses of decisions about ventilator support on the subgroup of patients with the diagnosis of acute respiratory failure (a group of patients for whom ventilator support was an important clinical issue beginning on study day 1), results were similar to the results of our primary analysis. Third, most patients included in analyses of decisions about dialysis had significant renal dysfunction at the time of study admission (the mean creatinine level on study day 1 was 380 μmol/L [4.3 mg/dL], and 78% of patients had creatinine levels on study day 1 of 177 μmol/L [2.0 mg/dL] or higher). Furthermore, when we repeated our multivariable analyses of decisions to withhold dialysis with the starting point defined as the first day a patient's creatinine level was greater than 265 μmol/L (3.0 mg/dL), results were similar to those of our primary analyses.

An additional limitation is that our data were collected at five teaching hospitals, and care practices with respect to patient age may be different in community hospitals and in settings where acute care is uncommon. Finally, we assumed that all three treatments were used to extend life. Surgery has been used as a palliative measure for some patients. However, the observed effect was consistent across all three treatments.

Despite these limitations, our findings suggest that health care providers are more likely to with-

hold life-sustaining treatments from elderly patients. This practice pattern does not seem to be driven by differences in patients' prognoses or preferences and is only partly explained by physicians' misunderstanding of patients' care preferences.

Further research is needed to better understand how age influences outcomes from invasive procedures and to better estimate the effectiveness as well as the cost-effectiveness of many major medical interventions for elderly patients. In addition, as efforts to contain escalating Medicare costs continue, societal discussion is needed to determine whether it is acceptable and desirable to withhold potentially beneficial health care on the basis of advanced age.

Appendix

I. Interview question regarding cardiopulmonary resuscitation preference: As you probably know, there are a number of things doctors can do to try to revive someone whose heart has stopped beating, which usually includes a machine to help breathing. Thinking of your current condition, what would you want your doctors to do if your heart ever stops beating? Would you want your doctors to try to revive you, or would you want your doctors not to try to revive you?

II. Interview question regarding life-extending care: If you had to make a choice at this time, would you prefer a course of treatment that focuses on extending life as much as possible, even if it means having more pain and discomfort, or would you want a plan of care that focuses on relieving pain and discomfort as much as possible, even if that means not living as long?

The test–retest reliability of these questions was 97% and 74%, respectively.

Note: This paper was presented in part at the National Meeting of the Society of General Internal Medicine, Washington, D.C., April 1994.

Disclaimer: The opinions and findings contained in this manuscript are those of the authors and do not necessarily represent the views of the Robert Wood Johnson Foundation or its Board of Trustees.

Grant Support: By the Robert Wood Johnson Foundation. Dr. Hamel is supported by a Career Development Award from the National Institute on Aging (K08 AG0075-02).

Requests for Reprints: Mary Beth Hamel, MD, MPH, Division of General Medicine and Primary Care, Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Boston, MA 02215.

Current Author Addresses: Drs. Hamel, Davis, and Phillips: Division of General Medicine and Primary Care, Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Boston, MA 02215.
Dr. Teno: Center for Gerontology and Health Care Research, Brown University, Box 6B-222, Providence, RI 02912.
Dr. Goldman: Department of Medicine, University of California, San Francisco, School of Medicine, 505 Parnassus Avenue, San Francisco, CA 94143-0120.
Dr. Lynn: Center to Improve Care of the Dying, George Washington University, 2175 K Street, NW, Suite 820, Washington, DC 20037.
Dr. Galanos: Division of Geriatrics, Duke University Medical Center, 353-Blue Zone, Durham, NC 27710.
Dr. Desbiens: Chattanooga Unit, University of Tennessee College of Medicine, 921 East Third Street, Chattanooga, TN 37403.
Dr. Connors: Department of Health Evaluation Sciences, University of Virginia School of Medicine, Box 600, Charlottesville, VA 22908.
Dr. Wenger: Department ot Medicine, University of California, Los Angeles, School of Medicine, B-564/Factor, 10833 Le Conte Avenue, Los Angeles, CA 90095-1736.

References

1. Guidelines on the termination of life-sustaining treatment and the care of the dying: a report by the Hastings Center. Briarcliff Manor, NY: The Hastings Center; 1987.
2. United States. President's Commission on the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research. Deciding to forgo life-sustaining treatment: a report on the ethical, medical, and legal issues in treatment decisions. President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research. Washington, DC: United States Government Printing Office; 1983.
3. **Brennan TA.** Ethics committees and decisions to limit care. The experience at the Massachusetts General Hospital. JAMA. 1988;260:803-7.
4. **Hamel MB, Phillips RS, Teno JM, Lynn J, Galanos AN, Davis RB, et al.** Seriously ill hospitalized adults: do we spend less on older patients? SUPPORT Investigators. Study to Understand Prognoses and Preference for Outcomes and Risks of Treatment. J Am Geriatr Soc. 1996;44:1043-8.
5. **Tunis SR, Bass EB, Klag MJ, Steinberg EP.** Variation in utilization of procedures for treatment of peripheral arterial disease. A look at patient characteristics. Arch Intern Med. 1993;153:991-8.
6. **Callahan D.** Setting Limits: Medical Goals in an Aging Society. New York: Simon & Schuster; 1987.
7. **Callahan D.** Must the old and young compete for health care resources? Neurosurgery. 1990;27:160-4.
8. **Callahan D.** Adequate health care and an aging society; are they morally compatible? Daedalus. 1986;(Winter):247-67.
9. **Veatch RM.** Justice and the economics of terminal illness. Hastings Cent Rep. 1988;18:34-40.
10. **Daniels N.** Is rationing by age ever morally acceptable? Bus Health. 1984;1: 29-32.
11. **Cassel CK, Neugarten B.** The goals of medicine in an aging society. In: Binstock RH, Post SG, eds. Too Old for Health Care? Controversies in Medicine, Law, Economics, and Ethics. Baltimore: Johns Hopkins Univ Pr; 1991.
12. **Dougherty CJ.** Ethical problems in healthcare rationing. Testimony to the Senate Special Committee on Aging. Health Prog. 1991;72:32-9.
13. **Jecker NS, Pearlman RA.** Ethical constraints on rationing medical care by age. J Am Geriatr Soc. 1989;37:1067-75.
14. **Evans JG.** Aging and rationing [Editorial]. BMJ. 1991;303:869-70.
15. **Lynn J, Knaus WA.** Background for SUPPORT. J Clin Epidemiol. 1990; 43(Suppl):1S-4S.
16. A controlled trial to improve care for seriously ill hospitalized patients. The Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT). The SUPPORT Principal Investigators. JAMA. 1995; 274:1541-8.
17. **Knaus WA, Wagner DP, Draper EA, Zimmerman JE, Bergner M, Bastos PG, et al.** The APACHE III prognostic system. Risk prediction of hospital mortality for critically ill hospitalized adults. Chest. 1991;100:1619-36.
18. **Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW.** Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. JAMA. 1963;185:914-9.
19. **Landefeld CS, Phillips RS, Bergner M.** Patient characteristics in SUPPORT: functional status. J Clin Epidemiol. 1990;43(Suppl):37S-39S.
20. **Hlatky MA, Boineau RE, Higginbotham MB, Lee KL, Mark DB, Califf RM, et al.** A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). Am J Cardiol. 1989;64:651-4.
21. **Phillips RS, Goldman L, Bergner M.** Patient characteristics in SUPPORT: activity status and cognitive function. J Clin Epidemiol. 1990;43(Suppl):33S-36S.
22. **Stone CJ, Koo CY.** Additive splines in statistics. Proceedings of the Statistical Computing Section of the American Statistical Assocation. 1985;45-8.
23. **Knaus WA, Harrell FE Jr, Lynn J, Goldman L, Phillips RS, Connors AF Jr, et al.** The SUPPORT prognostic model. Objective estimates of survival for seriously ill hospitalized adults. Study To Understand Prognoses and Preferences for Outcomes and Risks of Treatment. Ann Intern Med. 1995;122:191-203.
24. **Collett D.** Modelling Survival Data in Medical Research. London: Chapman and Hall; 1994:95-100.
25. **Allison PD.** Survival Analysis Using the SAS System: A Practical Guide. Cary, NC: SAS Institute; 1995:165-73.
26. **Yarzebski J, Goldberg RJ, Gore JM, Alpert JS.** Temporal trends and factors associated with pulmonary artery catheterization in patients with acute myocardial infarction. Chest. 1994;105:1003-8.

27. **Gurwitz JH, Osganian V, Goldberg RJ, Chen ZY, Gore JM, Alpert JS.** Diagnostic testing in acute myocardial infarction: does patient age influence utilization patterns? The Worcester Heart Attack Study. Am J Epidemiol. 1991;134:948-57.
28. **Bearden DM, Allman RM, Sundarum SV, Burst NM, Bartolucci AA.** Age-related variability in the use of cardiovascular imaging procedures. J Am Geriatr Soc. 1993;41:1075-82.
29. **Fleming C, D'Agostino RB, Selker HP.** Is coronary-care-unit admission restricted for elderly patients? A multicenter study. Am J Public Health. 1991; 81:1121-6.
30. **Naylor CD, Levinton CM, Baigrie RS, Goldman BS.** Placing patients in the queue for coronary surgery: do age and work status alter Canadian specialists' decisions? J Gen Intern Med. 1992;7:492-8.
31. **Greenfield S, Blanco DM, Elashoff RM, Ganz PA.** Patterns of care related to age of breast cancer patients. JAMA. 1987;257:2766-70.
32. **Hakim RB, Teno JM, Harrell FE Jr, Knaus WA, Wenger N, Phillips RS, et al.** Factors associated with do-not-resuscitate orders: patients' preferences, prognoses, and physicians' judgments. SUPPORT Investigators. Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment. Ann Intern Med. 1996;125:284-93.
33. **Lubitz JD, Riley GF.** Trends in Medicare payments in the last year of life. N Engl J Med. 1993;328:1092-6.
34. **Lubitz J, Beebe J, Baker C.** Longevity and Medicare expenditures. N Engl J Med. 1995;332:999-1003.
35. **Butler RN.** Age-ism: another form of bigotry. Gerontologist. 1969;9:243-6.
36. **Spence DL, Feigenbaum EM, Fitzgerald F, Roth J.** Medical student attitudes toward the geriatric patient. J Am Geriatr Soc. 1968;16:976-83.
37. **Geiger DL.** Note: how future professionals view the elderly: a comparative analysis of social work, law, and medical students' perceptions. Gerontologist. 1978;18:591-4.
38. **Baker R.** Visibility and the just allocation of health care: a study of age-rationing in the British National Health Service. Health Care Anal. 1993;1:139-50.
39. **Bowling A.** Health care rationing: the public's debate. BMJ. 1996;312:670-4.
40. **Prottas J, Segal M, Sapolsky HM.** Cross-national differences in dialysis rates. Health Care Financ Rev. 1983;4:91-103.
41. **McKenzie JK, Moss AH, Feest TG, Stocking CB, Siegler M.** Dialysis decision making in Canada, the United Kingdom, and the United States. Am J Kidney Dis. 1998;31:12-8.
42. **Murphy DJ, Burrows D, Santilli S, Kemp AW, Tenner S, Kreling B, et al.** The influence of the probability of survival on patients' preferences regarding cardiopulmonary resuscitation. N Engl J Med. 1994;330:545-9.
43. **Wetle T.** Age as a risk factor for inadequate treatment [Editorial]. JAMA. 1987;258:516.
44. **Wong JB, Salem DN, Pauker SG.** You're never too old [Letter]. N Engl J Med. 1993;328:971-5.
45. **Avorn J.** Benefit and cost analysis in geriatric care. Turning age discrimination into health policy. N Engl J Med. 1984;310:1294-301.
46. **Phillips RS, Wenger NS, Teno J, Oye RK, Youngner S, Califf R, et al.** Choices of seriously ill patients about cardiopulmonary resuscitation: correlates and outcomes. SUPPORT Investigators. Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments. Am J Med. 1996;100: 128-37.
47. **Frankl D, Oye RK, Bellamy PE.** Attitudes of hospitalized patients toward life support: a survey of 200 medical inpatients. Am J Med. 1989;86(6 Pt 1): 645-8.

The eye plays a major part in Egyptian mythology. The eye of Horus was torn out by Seth, but magically restored. . . . The restored and healthy (wedjat) eye then became a potent symbol for protection and cure, and is the subject of innumerable amulets. Its component parts were used to define fractions between 1/2 and 1/64 . . . and were used extensively in prescriptions.

John F. Nunn
Ancient Egyptian Medicine
London: British Museum Pr; 1996

Submitted by:
Donald A. Dibbern Jr., MD
The Johns Hopkins Hospital
Baltimore, MD 21287

Submissions from readers are welcomed. If the quotation is published, the sender's name will be acknowledged. Please include a complete citation, as done for any reference.—*The Editor*