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Predictors of Hospice Utilization among Acute Stroke Patients who Died within Thirty Days

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Abstract

Background: Hospice is considered to be underutilized, particularly among patients with noncancer diagnoses such as stroke. The highest mortality among stroke patients occurs within the first 30 days; however, we know little about the hospice enrollment decision for this population during this critical time frame.
Objectives: To determine hospice enrollment rates and to describe sociodemographic and clinical predictors of hospice utilization among patients who die within 30 days of their stroke.
Design: Retrospective analysis of administrative data.
Subjects: Medicare beneficiaries 65 years and older discharged with ischemic stroke from 422 hospitals and 11 metropolitan regions during the year 2000 who died within 30 days of their stroke.
Measures: Hospice utilization within 30 days.
Results: The overall hospice enrollment rate in our study was 23%. Using multivariable logistic regression, factors predicting increased hospice enrollment included older age, female gender, health management organization (HMO) membership, length of stay more than 3 days, and dementia. Factors predicting decreased enrollment included African American race, mechanical ventilation, gastrostomy tube placement, uncomplicated diabetes mellitus, and valvular disease. When in-hospital deaths were excluded, overall enrollment increased to 44%, and mechanical ventilation and dementia ceased to predict enrollment.
Conclusions: Hospice enrollment rates among patients who die within the first 30 days of their stroke, particularly among those who survive to discharge, are much higher than prior estimates suggest. Although overall enrollment rates were higher than anticipated, there remain important sociodemographic and clinical characteristics unique to this population that predict low hospice utilization that should serve as targets for further research and intervention.

Introduction

New or recurrent stroke affects 700,000 people per year, is the third leading cause of death in the United States, and in 2007 it is believed that the direct and indirect costs of this disease approached $63 billion.[1] End-of-life care needs in this population are substantial as evidenced by a one year mortality rate from stroke of 1 in 4 individuals aged 70 or older,[1] and an overall 30 day mortality rate of 10%–17%.[2–4] Hospice has been described as the gold standard for end-of-life care, and patients and families who utilize this service report being highly satisfied.[5–10]

Enrollment in hospice is rapidly increasing in the United States[11,12]; however, it is still felt to be an underutilized service,[13–16] particularly among patients with noncancer diagnoses such as stroke.[11,17,18] Iwashyna et al.[17] evaluated a cohort of seriously ill elderly patients from 1993 to 1997 and described patterns of hospice use specific to disease type. The rate of use among stroke patients was approximately 8%, while use among cancer patients ranged from approximately 15% to 35%.[17] In evaluating patients who died in 1993 from one of the leading causes of death in the United States, Teno et al.[18] found that only 3.1% of stroke patients utilized hospice compared to 19.7% of patients with cancer. These apparent discrepancies in enrollment rates are not readily explained, and further evaluation of this important popula-

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tion is necessary to determine whether patients dying of stroke are receiving optimal end-of-life care.

Previous studies have described differences in sociodemographic characteristics among Medicare beneficiaries facing the end of life which distinguish hospice enrollees from non-enrollees,[19–22] although it is not known if these findings translate to stroke patients. In general, lower hospice utilization has been seen for patients who are African American, have lower median household incomes, and who have been enrolled in traditional Medicare fee-for-service insurance plans as opposed to HMOs.[19–22] Marked regional and hospital variability in the use of hospice care has also been described.[20,21] Regions with lower HMO penetration and those with fewer hospital beds per capita are associated with lower rates of hospice utilization.[19,21] Hospital characteristics associated with lower utilization include greater numbers of hospital days per decedent and greater percentages of in-hospital deaths.[23] In contrast to sociodemographic and regional characteristics, with the exception of disease type, there is little description in the literature of clinical predictors of hospice utilization such as comorbidities or disease severity. Because so little is known about how the characteristics of patients dying of stroke relate to the hospice enrollment decision, we sought to describe what differs between those who enroll and those who do not.

To enhance the specificity and relevance of our results, we have chosen to focus on a population of stroke patients with particularly high end-of-life care needs: patients who die within 30 days of their stroke. It is known that the rate of mortality declines significantly after 30 days and remains relatively constant over the subsequent year.[2] What is not known is how our current health care system responds to the needs of this very ill population of patients and their families, including the role hospice may or may not have to play. It is thus critical to understand how the characteristics of patients who make up this unique population relate to the hospice enrollment decision.

Methods

Population and sampling

We identified Medicare beneficiaries 65 years of age and older discharged with acute ischemic stroke during the year 2000 in 11 metropolitan regions of the country. Patients were included in the sample if they had an *International Classification of Diseases, 9th edition* (*ICD-9*) diagnosis code of 434 or 436 in the first position on the discharge diagnosis list from an acute care hospitalization (which has been found to accurately identify acute ischemic stroke in 89%–90% of cases)[24] and if they died within 30 days of their stroke. If a patient had more than one acute ischemic stroke discharge over the study period, one discharge was randomly selected.

This approach did not require analyses accounting for repeated observations of the same patient.

We obtained health management organization (HMO) data from a large national managed care organization and fee-for-service (FFS) data from the Centers for Medicare and Medicaid Services (CMS). HMO data included patients enrolled in 11 Medicare Plus Choice plans serving 93 metropolitan counties primarily in the eastern half of the United States ($n = 260$ patients with acute ischemic stroke in 422 hospitals). Comparable data were obtained for all FFS patients ($n = 4634$) discharged with acute ischemic stroke in the same counties. This study was approved by the Institutional Review Board at the University of Wisconsin.

Data extraction

We utilized enrollment data and final institutional and physician/supplier claims for all study patients from 1 year prior to their index hospitalization up to the time of their death. Both HMO and FFS patients had claims submitted using standard CMS forms. For HMO patients, we also obtained enrollment and disenrollment data and all claims submitted to the HMO from out-of-network facilities. For both FFS and HMO patients, we obtained the Medicare denominator file to determine age, gender, race, zip code, Medicaid enrollment, and date of death. This file was used to exclude FFS beneficiaries who were missing Medicare Part A or Part B, had end-stage renal disease, received railroad retirement benefits, or were enrolled in an HMO at any point from 1 year prior to their index hospitalization to the time of their death.

Hospice enrollment status was obtained from Medicare hospice files. This includes enrollment in hospice-designated beds within a hospital.

Variables

The main dependent variable was hospice enrollment status within 30 days following the index hospital admission date.

We included individual and neighborhood sociodemographic characteristics as potential control variables. Individual characteristics included age, gender, race, the year of the index hospitalization, and an indicator identifying beneficiaries with low to modest income who are fully enrolled in Medicaid or receive help with Medicare cost-sharing through Medicaid. Zip+4 data were used to link patient data to the corresponding Census 2000 block group and obtain neighborhood socioeconomic characteristics including percent over 24 years of age with a college degree and percent below poverty line.[25]

To account for preexisting differences in comorbidity between hospice and nonhospice enrollees, individual comorbidities and measures of stroke severity and initial stroke treatment were also included as control variables. We identified 30 comorbid conditions by incorporating information from the index hospitalization, all hospitalizations during the prior year, and all physician claims during the prior year using methods proposed by Elixhauser et al.[26] and Klabunde, et al.[27] Of these 30 conditions, we directly included the 13 comorbidities present in over 5% of our sample as indicator variables. An "other comorbidity count" was generated for the remaining conditions present in less than 5% of our sample. We also coded the following: hospitalization during the year prior to the index hospitalization, dementia,[28] stroke during the year prior to the index hospitalization,[29] and concurrent cardiac events (acute myocardial infarction, unstable angina pectoris, coronary artery bypass graft, and cardiac catheterization).

Two validated indicator variables, mechanical ventilation (CPT 94656, 94657; ICD-9 96.7x)[30] and placement or revision of gastrostomy tube (CPT 43750, 43760, 43761, 43832, 43246; ICD-9 43.11),[31] were used to represent disease severity dur-

ing index hospitalization. We also included length of index hospital stay using categories of days equal to 0–3 days, 4–7, and greater than 7.

Analysis

The variables of hospice users and non-users as listed above were compared using t tests (continuous variables) and χ^2 tests (dichotomous variables). Unadjusted rates of hospice use per 100 deaths were calculated for each variable. Multivariable logistic regression was conducted to determine predictive relationships between the explanatory variables and hospice enrollment among stroke patients who died within 30 days of the index hospital admission date, as well as among the subset of patients who did not die in the hospital. Analyses were conducted using SAS version 8.0 (SAS Institute, Inc., Cary, NC) and StataSE 9.2 (StataCorp, College Station, TX). Results of the logistic regression analyses are reported in odds rations (ORs) and 95% confidence intervals (CIs). All CIs and significance tests were significant at $p < 0.05$ and were calculated using robust estimates of the variance that allowed for clustering of patients within hospitals. Models included age (65–69, 70–74, 75–79, 80–85, and >85), gender, race (Caucasian, African America, and other), Medicaid, HMO membership, percent of census block group aged 25 and older with college degrees, percent of census block group below the poverty line, length of index hospitalization stay, mechanical ventilation, gastrostomy tube placement, prior hospitalization, prior stroke, cardiac arrhythmias, congestive heart failure, chronic pulmonary disease, uncomplicated diabetes mellitus, complicated diabetes mellitus, hypertension, fluid and electrolyte disorders, valvular disease, peripheral vascular disorders, hypothyroidism, solid tumor without metastasis, deficiency anemia, depression, dementia, concurrent cardiac event, and other comorbidity.

Results

Descriptive characteristics

Overall, stroke patients who died within 30 days were older, more likely to be female than male, and had a high prevalence of comorbidity (Table 1). The average age was 83, with females comprising 66% of the study population and Caucasians comprising 87%. Nineteen percent of the patients had Medicaid and 95% were covered by traditional FFS Medicare. Approximately one third had an index hospitalization length of stay greater than 7 days. Mechanical ventilation and gastrostomy tube placement were markers of disease severity specific to this population, and were provided to 15% and 11% of the patients, respectively. One half of the patients experienced prior hospitalization within 1 year of the index hospitalization. The most common comorbidities were hypertension (69%), cardiac arrhythmias (57%), congestive heart failure (41%), fluid and electrolyte disorders (39%), dementia (29%), chronic pulmonary disease (24%), and uncomplicated diabetes mellitus (22%).

Unadjusted rates of hospice utilization

Of the 4894 patients included in the sample, 23.42% were enrolled in hospice (Table 2).

Each successive age group had a higher unadjusted rate of enrollment, ranging from 10% to 28%. Females and males had 25% and 20% enrollment rates respectively. Rates of enrollment among races ranged from 12% in African Americans to 25% in Caucasians and other minorities. Among Medicare beneficiaries, an enrollment rate of 26% was seen among HMO members compared to 23% among patients with traditional FFS plans. The enrollment rate was 24% for patients living in census block groups with less than 10% of individuals below the poverty line, versus 22% for patients living in census block groups with more than 10% of individuals below the poverty line. Subjects who received mechanical ventilation or gastrostomy tube placement had rates of enrollment of 11% and 12%, respectively. The enrollment rates among patients with select comorbid conditions ranged from 20% to 29%.

Predictors of hospice utilization

Multiple sociodemographic and clinical predictors of hospice utilization were found (Table 3). Older age, female gender, and HMO membership conferred an increased likelihood of hospice enrollment, whereas African American race conferred a decreased likelihood. An index hospitalization length of stay greater than 3 days was associated with an increased likelihood of hospice enrollment. Both mechanical ventilation and gastrostomy tube placement correlated highly with a decreased likelihood of hospice enrollment. Among the comorbidities, uncomplicated diabetes mellitus and valvular disease were associated with a decreased likelihood of hospice enrollment and dementia was associated with an increased likelihood.

Fifty-two percent of the patients died in the hospital. When these patients were excluded from the models of variables predicting hospice enrollment, significant changes were noted in hospice enrollment patterns (Table 4). Among this subgroup of patients, an overall rate of hospice enrollment of 44% was observed. There was no longer noted to be a detectable difference in enrollment relative to advancing age. Patients enrolled in Medicaid were now noted to have a decreased likelihood of hospice enrollment as compared to non-Medicaid patients, whereas HMO membership no longer predicted an increased likelihood of hospice enrollment. Patterns of prediction for index hospitalization length of stay also changed significantly, such that a length of stay longer than 3 days predicted decreased hospice enrollment.

Gastrostomy tube placement continued to be predictive of low hospice enrollment rates, while mechanical ventilation changed dramatically from being significantly predictive of low hospice enrollment to having no apparent effect. The comorbid conditions of uncomplicated diabetes mellitus and valvular disease continued to predict decreased hospice enrollment rates; however, dementia was no longer predictive of hospice enrollment.

Discussion

One of the most striking findings in this study is the overall hospice enrollment rate of 23%, a number which is at least triple previously published reports on stroke patients. Even more striking, perhaps, is the finding of an overall enrollment rate of 44% among those patients who survived the index hospitalization. While it is true that practice patterns are

Table 1. Key Characteristics of Acute Stroke Patients Who Died within Thirty Days (N = 4,894)[a]

Characteristic	*Total*	*Hospice* (n = *1146*)	*Nonhospice* (n = *3748*)	p *value*
Sociodemographic				
Average age in years, mean (SD)	83 (8)	85 (7)	83 (8)	0.000
65–69 years	5	2	6	
70–74 years	10	7	10	
75-79 years	17	13	18	
80–84 years	22	22	21	
≥85 years	47	56	44	
Male	34	30	35	0.000
Female	66	70	65	0.000
Caucasian	87	92	85	0.000
African American	10	5	12	0.000
Other minority	3	3	3	0.713
Medicaid	19	16	20	0.003
Non-Medicaid	81	84	80	0.003
FFS Member	95	94	95	0.284
HMO Member	5	6	5	0.284
% in block group below the poverty line, mean (SD)	11 (11)	10 (9)	11 (11)	0.000
% adults ≥ 25 years in block group with college degree, mean (SD)	25 (18)	26 (17)	24 (18)	0.001
Index hospitalization-LOS				
0–3 days	30	27	31	
4–7 days	39	45	37	
Above 7 days	31	27	32	
Disease severity				
Mechanical ventilation	15	7	17	0.000
Gastrostomy tube	11	6	13	0.000
Prior medical history				
Prior hospitalization	50	53	49	0.012
Prior stroke	7	8	7	0.094
Cardiac arrhythmias	57	58	56	0.243
Congestive heart failure	41	40	41	0.730
Chronic pulmonary disease	24	21	25	0.003
Diabetes mellitus, uncomplicated	22	18	23	0.001
Diabetes mellitus, complicated	7	6	8	0.111
Hypertension	69	68	70	0.327
Fluid and electrolyte disorders	39	38	39	0.611
Valvular disease	17	17	17	0.649
Peripheral vascular disorders	17	17	18	0.549
Hypothyroidism	14	18	13	0.000
Solid tumor without metastasis	13	15	12	0.034
Deficiency anemias[b]	20	23	19	0.004
Depression	9	10	9	0.118
Dementia	29	35	27	0.000
Concurrent cardiac event	5	4	5	0.388
Other comorbidity count	0.60 (0.83)	0.63 (0.85)	0.59 (0.83)	0.162

[a]Values represent percents unless specified otherwise.
[b]Includes anemias due to a nutritional deficiency (e.g., iron, vitamin B_{12}, folate, protein, etc.).
SD, standard deviation; LOS, length of stay.

changing as evidenced by a rise in hospice utilization rates in the United States of 162% in the last decade,[32] this trend alone is insufficient to explain the enrollment rates we observed. A more probable explanation lies within our choice of study population: patients who died within 30 days of their stroke. Estimates of hospice utilization from prior studies have not focused on any particular type of stroke patient.[17,18] It is therefore possible that enrollment rates among stroke patients with 30 day mortality has been quite high relative to other hospice diagnoses all along, and that these results have been obscured by applying the hospice enrollment measure over a very broad group of stroke patients ultimately facing very different circumstances at their end-of-life.

Although use of hospice overall was found to be higher than expected, important clinical predictors of low utilization were found within our study population. Not surprisingly, those patients who received mechanical ventilation had overall significantly lower utilization of hospice as compared to patients who did not receive this aggressive life-

TABLE 2. UNADJUSTED RATE OF HOSPICE USE PER ONE HUNDRED DEATHS BY KEY CHARACTERISTICS OF ACUTE STROKE PATIENTS WHO DIED WITHIN THIRTY DAYS (N = 4,894)

Characteristic	*Hospice use*	*Overall*	*Unadjusted rate of hospice use per 100 deaths (%)*
Overall	1146	4894	23.42
Sociodemographic			
Age			
65–69 years	25	243	10
70–74 years	79	472	17
75-79 years	154	838	18
80–84 years	248	1052	24
> 85 years	640	2289	28
Gender			
Male	341	1666	20
Female	805	3228	25
Race			
Caucasian	1051	4255	25
African American	58	489	12
Other minority	37	150	25
Medicaid			
Medicaid	183	931	20
Non-Medicaid	963	3963	24
FFS/HMO			
FFS Member	1078	4634	23
HMO Member	68	260	26
Census—Income			
≥10% of individuals in block group below the poverty line	504	2255	22
<10% of individuals in block group below the poverty line	642	2639	24
Census—Education			
≥25% of adults ≥ 25 years in block group without college degree	586	2240	26
<25% of adults ≥ 25 years in block group without college degree	560	2654	21
Index hospitalization			
0–3 days	311	1469	21
4–7 days	521	1920	27
Above 7 days	314	1505	21
Disease severity			
Mechanical ventilation	81	714	11
Gastrostomy tube	68	548	12
Prior medical history			
Prior hospitalization	611	2451	25
Prior stroke	95	351	27
Cardiac arrhythmias	666	2771	24
Congestive heart failure	464	2003	23
Chronic pulmonary disease	241	1192	20
Diabetes mellitus, uncomplicated	206	1054	20
Diabetes mellitus, complicated	70	351	20
Hypertension	779	3384	23
Fluid and electrolyte disorders	435	1889	23
Valvular disease	193	846	23
Peripheral vascular disorders	193	853	23
Hypothyroidism	201	701	29
Solid tumor without metastasis	169	632	27
Deficiency anemias[a]	263	979	27
Depression	120	455	26
Dementia	403	1427	28
Concurrent cardiac event	48	228	21
Other comorbidity count			
0 count	643	2829	23
1 count	336	1414	24
≥ 2 counts	167	651	26

[a]Includes anemias due to a nutritional deficiency (e.g., iron, vitamin B_{12}, folate, protein, etc.).
FFS, fee for service; HMO, health maintenance organization.

Table 3. Adjusted Odds Ratios and 95% Confidence Intervals for Factors Predicting Hospice Enrollment (N = 4,894)

Characteristic	*OR of hospice use*	*95% CI*
Sociodemographic		
70–74 years[a]	1.33	(0.73, 2.4)
75-79 years[a]	1.53	(0.91, 2.57)
80–84 years[a]	1.90	(1.13, 3.17)
> 85 years[a]	2.18	(1.3, 3.65)
Female	1.28	(1.08, 1.52)
African American[b]	0.66	(0.46, 0.95)
Other minority[b]	0.92	(0.53, 1.63)
Medicaid	0.91	(0.73, 1.14)
HMO Member	1.51	(1.11, 2.05)
% in block group below the poverty line (standard deviation)	0.35	(0.12, 1.03)
% adults ≥ 25 years in block group with college degree (standard deviation)	1.02	(0.57, 1.8)
Index hospitalization		
4–7 days[c]	1.36	(1.12, 1.65)
Above 7 days[c]	1.29	(1.01, 1.65)
Disease severity		
Mechanical ventilation	0.37	(0.28, 0.5)
Gastrostomy tube	0.42	(0.32, 0.56)
Prior medical history		
Prior hospitalization	1.14	(0.94, 1.38)
Prior stroke	1.08	(0.8, 1.46)
Cardiac arrhythmias	0.94	(0.79, 1.12)
Congestive heart failure	0.88	(0.74, 1.04)
Chronic pulmonary disease	0.83	(0.67, 1.01)
Diabetes mellitus, uncomplicated	0.80	(0.65, 0.99)
Diabetes mellitus, complicated	0.96	(0.69, 1.34)
Hypertension	0.96	(0.8, 1.15)
Fluid and electrolyte disorders	0.93	(0.79, 1.1)
Valvular disease	0.80	(0.65, 0.98)
Peripheral vascular disorders	0.95	(0.78, 1.17)
Hypothyroidism	1.09	(0.89, 1.35)
Solid tumor without metastasis	1.19	(0.96, 1.48)
Deficiency anemias	1.21	(0.99, 1.47)
Depression	1.13	(0.85, 1.51)
Dementia	1.27	(1.05, 1.54)
Concurrent cardiac event	0.97	(0.68, 1.38)
Other comorbidity count	1.03	(0.93, 1.14)

[a]Age baseline category: age 65–69
[b]Race baseline category: White
[c]LOS baseline category: 0–3 days
OR, odds ratio; CI, confidence interval; HMO, health maintenance organization.

prolonging measure. It remains unclear exactly how these critically ill stroke patients and their families are approached by our current system of care,[33] and in particular there is no description in the literature as to how decisions are made about the role of hospice for this group of patients and their families. What is clear is that when one considers only those individuals in our dataset who survive the index hospitalization, use of mechanical ventilation no longer stands as a predictor of hospice enrollment. This suggests that the majority of the mechanically ventilated patients with 30-day mortality are actually dying in the hospital, likely in the context of a terminal wean from ventilatory support. The lack of hospice in this equation may not be an omission that should be sought to be corrected, but rather a reasonable consequence of a dying trajectory in which the decision to discontinue life-prolonging care coincides nearly simultaneously with the time of death. Hospital based palliative care programs may be better positioned to address the needs of this particular group of patients and their families.[34,35]

Patients who received artificial nutrition with placement of a gastrostomy tube were also found to be much less likely to enroll in hospice, a finding which persisted even after inpatient deaths were excluded from the analysis. This suggests that a greater proportion of these patients are surviving to discharge in comparison to patients who receive mechanical ventilation. Yet they remain a very ill population with a clear need for focused end-of-life care. Nearly 50% of stroke patients in a large multicentered trial who received tube feedings were dead at 6 months, and an additional 30% to 40% had poor outcomes with Modified Rankin Scores of

Table 4. Adjusted Odds Ratios and 95% Confidence Intervals for Factors Predicting Hospice Enrollement Excluding Patients Who Died During the Index Hospitalization (N = 2,591)

Characteristic	*OR of hospice use*	*95% CI*
Sociodemographic		
70–74 years[a]	1.45	(0.73, 2.88)
75-79 years[a]	1.47	(0.81, 2.65)
80–84 years[a]	1.66	(0.93, 2.96)
> 85 years[a]	1.59	(0.89, 2.84)
Female	1.23	(1, 1.52)
African American[b]	0.65	(0.43, 0.97)
Other minority[b]	1.05	(0.53, 2.05)
Medicaid	0.74	(0.58, 0.96)
HMO Member	1.41	(0.96, 2.07)
% in block group below the poverty line (standard deviation)	0.35	(0.1, 1.2)
% adults ≥ 25 years in block group with college degree (standard deviation)	1.10	(0.55, 2.18)
Index hospitalization		
4–7 days[c]	0.74	(0.58, 0.94)
Above 7 days[c]	0.69	(0.51, 0.93)
Disease severity		
Mechanical ventilation	1.46	(0.98, 2.18)
Gastrostomy tube	0.28	(0.21, 0.37)
Prior medical history		
Prior hospitalization	1.07	(0.84, 1.35)
Prior stroke	1.02	(0.72, 1.45)
Cardiac arrhythmias	1.09	(0.88, 1.34)
Congestive heart failure	0.83	(0.67, 1.03)
Chronic pulmonary disease	0.81	(0.64, 1.04)
Diabetes mellitus, uncomplicated	0.74	(0.58, 0.95)
Diabetes mellitus, complicated	0.71	(0.47, 1.06)
Hypertension	0.96	(0.78, 1.18)
Fluid and electrolyte disorders	0.97	(0.79, 1.19)
Valvular disease	0.76	(0.59, 0.99)
Peripheral vascular disorders	0.83	(0.65, 1.05)
Hypothyroidism	1.28	(0.99, 1.65)
Solid tumor without metastasis	1.03	(0.79, 1.34)
Deficiency anemias	1.20	(0.94, 1.55)
Depression	0.95	(0.68, 1.33)
Dementia	1.04	(0.84, 1.29)
Concurrent cardiac event	1.41	(0.87, 2.28)
Other comorbidity count	0.97	(0.85, 1.11)

[a]Age baseline category: age 65–69.
[b]Race baseline category: White.
[c]LOS baseline category: 0–3 days.
OR, odds ratio; CI, confidence interval; HMO, health maintenance organization.

4 or 5.[36,37] A conversation about the decision-making process that leads to gastrostomy tube placement is beyond the scope of this discussion; however, once the decision has been made, the low hospice enrollment rates seen in our study would suggest that gastrostomy tubes pose a major barrier to hospice enrollment among this very ill population of patients. It is important to note that some hospices may not consider tube feeding consistent with the hospice philosophy, thereby precluding hospice enrollment but not necessarily preventing high-quality end-of-life care.

Among the chronic comorbid conditions, dementia alone predicted an increased rate of hospice enrollment for acute stroke patients. A similar pattern was seen by Haydar et al.,[38] who in evaluating end-of-life care planning among congestive heart failure patients found that those patients with dementia as a comorbid condition were more likely to have a care plan heavily directed toward comfort and anticipation of dying. This may be due in part to the lack of decision making capacity among patients with advanced dementia, and therefore the frequent involvement of surrogate decision makers. It is known that health care providers and significant others perceive the quality of life of their patients and loved ones with chronic diseases to be lower than do the individuals themselves.[39] It is also known that when persons are posed scenarios of debilitating and life-threatening illness, the healthier they are at baseline the less likely they are to describe a desire for aggressive life-prolonging treatments.[40]

Our study has several limitations. Administrative data lack information on functional status; therefore, we were unable to more precisely categorize stroke severity. The dataset also lacks critical information on the knowledge of as well as attitudes and beliefs toward end-of-life care among patients, families, and health care providers. All of these factors are generally known to have a substantive effect on the hospice enrollment decision.[9,15,41,42] Inherent in the study design is the inability to comment on either enrollment rates or factors affecting the enrollment decision among stroke patients who survive beyond 30 days.

Despite these limitations, some very clear conclusions have been drawn. The notion that stroke patients underutilize hospice in comparison to other high-mortality diagnoses such as cancer does not hold true in the population we studied. Prior studies have not accounted for the vast differences in end-of-life trajectories for patients who die relatively quickly from stroke (i.e., within 30 days) as opposed to patients who die following a longer period of disability. The findings in our study serve to further reinforce the notion that standards of care at the end of life should not be applied according to a particular *ICD-9* code but rather should be applied discriminately in accordance with distinct dying trajectories. Among patients who die of stroke within 30 days, further attention should be given to understanding our approach to caring for those individuals who receive aggressive life-prolonging measures such as mechanical ventilation and gastrostomy tube placement.

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