End of Life Care for Older Patients at a Tertiary Academic Medical Center

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ABSTRACT

Objective: To examine the intensity and amount of care at the end of life given to elderly patients at a tertiary academic medial center.

Methods: Review of a decedent care database that contains basic information on all deaths occurring at its associated academic medical center. Data was examined for deaths of patients 55 and older that occurred between July 1, 2000 and March 31, 2002. Data related to specific location of death were reclassified into the categories "ICU" and "Floor," and data related to the specific service on which death occurred were reclassified into the categories "Medical" and "Surgical." Essential demographic information including gender, race, and service were analyzed for all patients. Location of death was analyzed as a proxy variable for intensity of care received at the end of life, and length of stay before death was analyzed as a proxy variable for the amount of care received at the end of life. Analyses were performed using the age categories of 55-65, 65-75, 75-85, and >85 years of age.

Results: There were no statistically significant differences in gender, race and service among the different age categories of patients at the end of life. There were statistically significant differences in location of death with increasing age of patients (Age 55-65: 64% ICU, 36% Floor; Age 65-75: 58% ICU, 42% Floor; Age 75-85: 49% ICU, 51% Floor; Age >85: 41% ICU, 59% Floor). These differences remained statistically significant after controlling for gender, race and service ($p<0.001$). When location of death was stratified by service, the differences in location of death remained statistically significant for deaths occurring on a medical service ($p<0.001$) but not for deaths occurring on a surgical service ($p=0.378$) although patients on a surgical service still tended to die outside of the ICU as age increased. There were also statistically significant differences in length of stay before death with increasing age of patients (Age 55-65: mean 13.0 days (95% CI 11.1, 14.9); Age 65-75: 14.5 (12.8, 16.1); Age 75-85: 11.9 (10.0, 13.8); Age >85: 7.2 (4.0, 10.4)). These differences remained statistically significant after controlling for gender, race, location and service ($p=0.001$). When stratified by location, the differences in length of stay before death remained statistically significant for both deaths occurring in the ICU ($p<0.05$) and deaths occurring outside the ICU ($p=0.05$).

Conclusions: At a major tertiary academic medical center, older patients are less likely to receive end-of-life care equal in intensity or amount to the care received by younger patients.

INTRODUCTION

It is clear that the high and rising costs of health care have once again assumed a central position in the consciousness of American voters and their elected officials. In March 2002 a national survey conducted by the Kaiser Family Foundation and Harvard's Kennedy School of Government showed that voters identified rising costs of healthcare and health services as the number one "most important health care problem facing the country today."[1] Former Georgia Gov. Roy Barnes recently declared "health care is the dominant issue for the foreseeable future in politics."[2]

The tangled web of healthcare financing and services in America today makes it difficult to dissect the causes for rapidly rising costs and to find ways to stem the tide. However, certain details relating to the consumers of health care and the costs of care they consume are clear. In an era where everything healthcare-related comes under increased scrutiny for possible cost-saving measures, these details may cause us to reflect upon who we are providing care to and what kind of care we are providing.

First, the US population is aging and older Americans consume more health care. In 2000, persons 65 years or older numbered 35.0 million and represented 12.4% of the US population. Growth estimates suggest that by 2030 there will be 70 million persons aged 65 years or older and these persons will represent a full 30% of the US population at that time. This growing segment of the US population consumes a substantial portion of health care resources. In 1997, more than half (54%) of persons over age 65 reported having at least one disability of some type. Persons over age 65 had about four times the number of days of hospitalization as did the under 65 age population, and older persons averaged more contacts with doctors in 1999 than the general population (6.8 contacts vs. 3.5 contacts). Finally, older Americans spent 11% of their total expenditures on health, more than twice the proportion spent by all consumers.[3]

Second, more advanced but more expensive technology has also fueled increasing costs of health care services. This may be seen best where technology is most concentrated, namely hospitals. Perhaps two of the best metrics for looking at costs in the hospital are length of stay and costs in the ICU. The SUPPORT study analyzed 9105 adults with one of nine life-threatening diagnoses over a period of five years at five academic medical centers. SUPPORT investigators recently examined hospital charges and length of stay in these hospitals and discovered that a model incorporating therapeutic interventions (using the TISS scoring system) and length of stay was well correlated ($r=0.86$) with hospital charges, independent of site and inflation.[4] The charges in teaching hospitals associated with increasing lengths of stay can be very expensive. A recent study looking at charges in one particular academic medical center showed that for 2,614 patients with a length of stay of 4 days, mean total costs were $6,782+/-$96, and for 2,152 patients with a length of stay of ≥15 days, mean total costs were $49,246 +/-$999.[5] Costs are extraordinary in the ICU in particular. In 1995, expenditures on hospital care were $350 billion and constituted the largest proportion of the $989 billion spent on health care. Assuming that ICU costs were 20% of all hospital costs, then ICU costs were around $70 billion at that time, constituting approximately 1% of the GDP.[6] Daily ICU costs may range from $2000 to $3000 per patient in many US hospitals.[7]

Third, costs at the end of life are especially expensive. In 1993, 77% of Medicare decedents' expenditures occurred in the last year of life, while 52% of them occurred in the last 2 months and 40% in the last month. Of these costs, inpatient hospital expenses accounted for 70%.[8] In the aggregate, these expenses account for billions of dollars.[9] It is not clear that all of this money is well spent, particularly for those patients for whom death is imminent. The SUPPORT study demonstrates that the incremental cost per Quality Adjusted Life Year (QALY) for intensive ICU interventions in patients with a less than 50% chance of surviving at least two months after diagnosis did not compare favorably with other medical interventions.[10] Costs in the surgical intensive care unit are similarly high. One study that examined the cost of dying in the surgical intensive care unit uncovered an array of expensive laboratory and radiologic tests performed on patients in the last 48 hours of life that yielded data that may have been either unnecessary or capable of being obtained in other ways.[11]

Escalating costs in our hospitals and intensive care units combined with an aging population that consumes greater amounts of health care, particularly at the end of life, suggests that we might consider limiting care to the elderly in order that we might contain costs now and avert costs in the future. This idea is not new. In 1987 ethicist Daniel Callahan put forth an impassioned argument for rationing care for the elderly at the end of life.[12] Underlying his arguments was the premise that "medicine should have as its specific goal that of averting premature death, understood as death prior to a natural life span …" and he went on to define a "natural life span" as "the late 70s or early 80s." In his view, government should not pay for life-extending technologies for patients older than the end of that 'natural life span.' This thinking continues to underlie his arguments today as well as the arguments of other thinkers.[13]

However, proponents of limiting ICU and hospital care provided to the elderly would need to prove a few conditions. In general, they would need to show that aggressive hospital care for the elderly is ineffective and of little benefit. More narrowly, they would need to predict the end of life in order to limit the most expensive and futile aggressive care that would have been provided to this segment of the population. However, evidence from the literature shows that these conditions are difficult to meet.

First, aggressive care for elderly patients is actually more likely to extend life by a year than to be futile. One early analysis of aggregate Medicare claims data from 1978 showed that among enrollees who cost Medicare more than $20,000, 24,000 died while 25,000 survived through the year.[14] Although SUPPORT investigators demonstrated a 1-2% increase in hazard of death with increasing age for some serious conditions,[15] other studies show low absolutely mortality rates for acute hospitalizations among the oldest old. In one study conducted over a five year period, two of 52 hospitalizations for persons ≥ 100 years of age led to death.[16] Another study examined 43 patients aged 95 to 99 years over a one year period and discovered only two inpatient deaths.[17]

Looking at the ICU in particular, researchers in Canada retrospectively examined over 50,000 patients admitted through all hospitals in British Columbia from 1994-1996 and demonstrated an average odds ratio for long-term mortality of 1.60 (95% CI 1.58, 1.62) for each decade increase in age.[18] Nevertheless, other studies show mid-long term survival rates between 60-85% for older patients after treatment in the ICU. One of these studies used 1992 data from the Health Care Financing Administration to demonstrate that of patients $\geq$ 85 years of age, 62% receiving ICU care survived at least 90 days after discharge.[19] Another study with longer follow-up showed that among patients $\geq$85 years of age who lived up to 6 months after hospital discharge, 86% survived to one year with little change in functional status from baseline.[20] A study comparing older patients surviving the ICU to younger patients surviving the ICU showed that at one year post-ICU discharge, older patients ($\geq$age 65) had similar abilities to carry out activities of daily living than younger patients, and had more positive health attitudes than younger survivors as well.[21]

For many patients, old or young, it is difficult to predict death and to determine who will benefit from aggressive treatment and who will not. Most recently, SUPPORT data demonstrated that at a week before death for the entire SUPPORT cohort, the median predicted chance of survival for 2 months was about 50%. Prognoses varied widely among diseases.[22] Other research confirms the unpredictability of death.[23]

If one accepts data that demonstrates high rates of survival among the elderly after receiving aggressive care, and that shows that the exact timing of death is hard to predict for both younger and older patients, then it seems that younger and older patients ought to be receiving inpatient care of similar aggressiveness. Most data that addresses this issue is either in the aggregate from national sampling or reflects information collected as part of the SUPPORT study. An examination of 1992 Medicare data revealed that admissions for cardiovascular procedures and for cancer chemotherapy decreased with age, and concluded that major procedures appear to be used with restraint in the very old.[24] An analysis of 1996 Medicare data from Massachusetts and California specifically looking at care at the end of life for older patients showed that ICU admissions, all procedures and overall hospital expenditures decreased for patients ≥85 years old "regardless of cause and site of death."[25]

The SUPPORT data reflect more of the same. One early analysis of SUPPORT data found that patients over 80 years of age were less likely to undergo major surgery, dialysis, and right heart catheter placement than younger patients.[26] A study of all hospitals in a state showed that persons over age 90 had lower rates of aggressive care than younger patients and were more likely to be admitted to hospitals where more aggressive interventions were not offered.[27,28] Another analysis held functional status constant and, on the basis of DNR orders still found that older patients received less aggressive care than younger patients.[29]

The research to date comparing end of life care between younger and older patients is incomplete and contains several deficiencies, however. First, the data is mostly in the aggregate and thus cannot account for several confounding factors that might have affected the results. For example, using Medicare data to compare admissions for several common procedures across age groups does not take into consideration the various possible reasons why older patients were not admitted for these procedures. Factors relating to patient preferences may explain why patients did not receive certain procedures or chose to go to hospitals where more aggressive interventions were not offered. Most articles also do not account for functional status – there may be specific reasons why certain older persons do not receive aggressive interventions that their younger counterparts receive. Finally, little data exist that examine aggressiveness and amount of care consumed between younger and older patients at the level of a specific hospital. Different types of hospitals may have different philosophies with respect to the use of aggressive interventions, and may care for varying proportions of younger and older patients. An ideal hospital setting to examine would be a teaching hospital, since these types of hospitals are known to have higher costs in the Medicare population and lower mortality rates than other types of hospitals.[30] Higher costs in teaching hospitals may be partially based on longer lengths of stay in these types of hospitals.[31]

Our study, therefore, focuses on a major teaching hospital, analyzing all deaths over a 20-month period to examine the amount of hospital care (using hospital length of stay) and aggressiveness of hospital care (using ICU deaths) that older patients receive at the end of life.

MATERIALS AND METHODS

Study Population

This paper uses data collected as part of Duke University Medical Center's Decedent Care Database. Information in the database was obtained by decedent care representatives at the time of death in a manner demonstrated to be both accurate and reliable. This database contains basic information on all patients dying at Duke hospital, including age, race, and gender of the decedent; location of death (categorized by hospital ward number); and service on which death occurred (categorized by particular clinical service unit, for example: cardiology, thoracic surgery, oncology). For the purposes of this study, data were used from all deaths of patients $\geq$55 years of age occurring at Duke Hospital between July 1, 2000 and March 1, 2002 (N=1366).

Variable Coding

For the analyses, the variable for age was divided into four categories: 1) Age 55-65; 2) Age 65-75; 3) Age 75-85; 4) Age$\geq$85. The variable for race was dichotomized into the categories "Caucasian" and "Non-Caucasian." The variable for location of death was divided into three categories: 1) "ICU"; 2) "Floor"; and 3) "Neither." This was done in the following manner: "ICU" included deaths occurring on wards 2200, 3200, 4200, 6200, 7200, 8200, and 9200, all of which are various ICUs at Duke Hospital. "Floor" included deaths occurring on wards 2100, 2300, 3100, 3300, 4100, 4300, 6100, 6300, 7100, 7300, 8100, 8300, 9100, and 9300, all of which are non-intensive care wards at Duke Hospital that contain medical and surgical patients. "Neither" included deaths that did not occur while under the care of a team in one of the floor or ICU wards (for example, Emergency Room and Operating Room). The variable for service was divided into three categories: 1) "Medical"; 2) "Surgical"; and 3) "Neither." This was done in the following manner: "Medical" included deaths occurring on all services known to care for patients with medical conditions (for example: Oncology, Cardiology, Neurology, General Medicine) as well as deaths occurring in ICUs known to carry patients with medical conditions (for example: Medical Intensive Care Unit). "Surgical" included deaths occurring on all services known to care for patients with surgical conditions (for example: Trauma, Cardiac Surgery, Neurosurgery, General Surgery) as well as deaths occurring in ICUs known to carry patients with surgical conditions (for example: Surgical Intensive Care Unit). "Neither" included deaths that did not occur on a medical or surgical service (deaths occurring in the Emergency Room). The variable for length of stay was left as a continuous variable as originally collected in the Decedent Care Database, with length of stay measured in days since admission to the hospital.

Statistical Analysis

Summary statistics were used to analyze all of the study variables. Each variable was examined in its own right before being included in bivariate analyses. For the bivariate analyses, the variables for gender, race, service on which death occurred and location at which death occurred were compared to the categorical age variable using the Pearson's Chi-squared test. After these unadjusted analyses were performed, all variables were simultaneously fit into a logistic regression model to examine the relationship between "Location" and the categorical age variable. The initial model contained all of the study variables in the previous bivariate analyses, which were location of death and the potential confounders of gender, race, length of stay and service on which death occurred. The variables for gender, race, and length of stay did not significantly affect the relationship between age and location of death and were thus removed from the final model.

All variables were also fit into a linear regression model to examine the relationship between length of stay and the categorical age variable. The initial model contained age and the potential confounders of gender, race, location and service. Gender and race did not significantly affect the relationship between length of stay and age and thus were removed from the final model. The final model included all remaining variables and the estimates from this model were used to confirm the adjusted lengths of stay for decedents in the different age categories. This linear regression strategy was repeated to examine the relationship between age and length of stay for deaths occurring in the intensive care unit, and for deaths occurring outside of the intensive care unit.

RESULTS

Baseline Characteristics

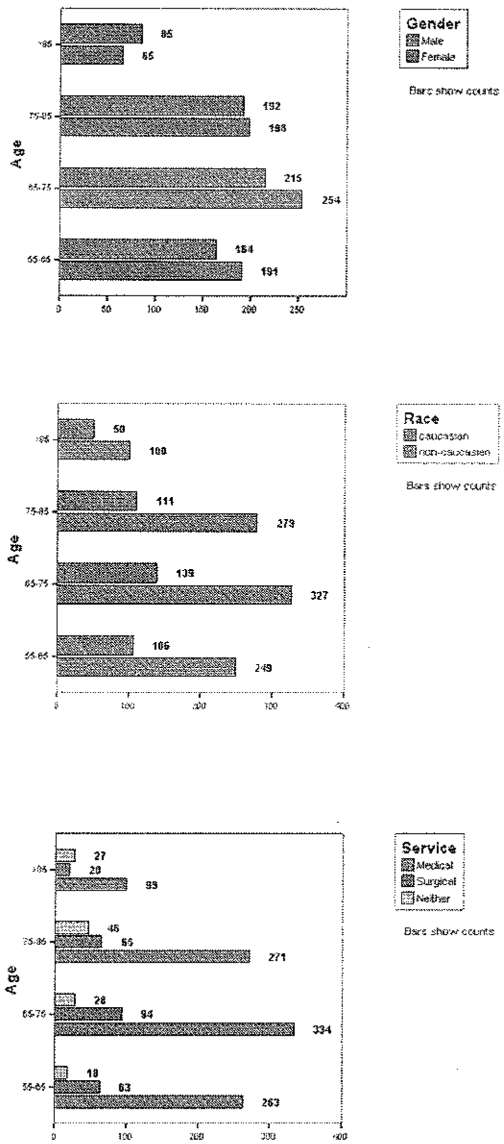
Table 1 shows the baseline characteristics of the 1366 decedents included in this study, excluding location of death (this is included in Table 2). Participants were divided roughly evenly into the different age categories with 26% of decedents between the ages of 55-65, 34% between the ages of 65-75, 29% between the ages of 75-85, and a somewhat smaller proportion (11%) over the age of 85.

Table 1: Baseline Characteristics of Patients $\geq$55y at Time of Death (All patients)
Source: Duke Hospital Decedent Care Database 7/1/00-3/1/02

	Age: 55-65	**Age: 65-75**	**Age: 75-85**	**Age: >85**	**Total**
N	355 (26.0%)	470 (34.4%)	391 (28.6%)	150 (11.0%)	1366 (100.0%)
Male	191 (53.8%)	254 (54.2%)	198 (50.8%)	65 (43.3%)	708 (51.9%)
Female	164 (46.2%)	215 (45.8%)	192 (49.2%)	85 (56.7%)	656 (48.1%)
Caucasian	249 (70.1%)	327 (70.2%)	279 (71.5%)	100 (66.7%)	955 (70.2%)
Non-caucasian	106 (29.9%)	139 (29.8%)	111 (28.5%)	50 (33.3%)	406 (29.8%)
Medical	263 (76.5%)	334 (73.3%)	271 (70.9%)	99 (67.8%)	967 (72.8%)
Surgical	63 (18.3%)	94 (20.6%)	65 (17.0%)	20 (13.7%)	242 (18.2%)
Neither (ER/OR)	18 (5.2%)	28 (6.1%)	46 (12.0%)	27 (18.5%)	119 (9.0%)

There were about as many males (52%) as females (48%) in this study, with a trend of more males than females in the younger age groups (age 55-65: 54% males, 46% females) and more females than males in the older age groups (age $\geq$85: 67% males, 33% females). However, these differences were not statistically significant. There were considerably more Caucasians (70%) than non-Caucasians (30%), and these proportions remained relatively constant across the different age categories. The relationship between race and age of decedents was not statistically significant. Finally, more patients died on medical services (73%) than surgical services (18%) in this study. These proportions remained relatively constant across the different age categories. The relationship between service and age was not statistically significant. Figure 1 pictorially depicts t\he relationships of gender, race, and service with age.

Figure 1: Relationships of baseline characteristics with age.



Relationship Between Age and Location of Death

Table 2 demonstrates a summary of the percentages of decedents of various ages dying in the ICU or on the Floor. Overall, 56% of patients in this study died in the ICU while 44% died on the Floor.

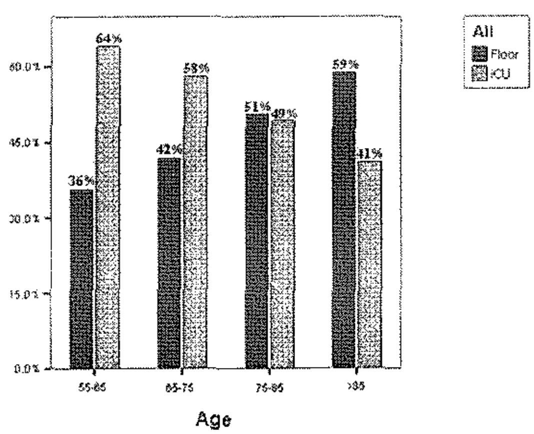
Table 2: Location of death (ICU vs. Floor) for Patients $\geq$55y at Time of Death
Source: Duke Hospital Decedent Care Database 7/1/00-3/1/02

	Age: 55-65	**Age: 65-75**	**Age: 75-85**	**Age: >85**	**Total**
ICU	212 (64.2%)	250 (58.1%)	167 (49.3%)	49 (41.2%)	678 (55.7%)
Floor	118 (35.8%)	180 (41.9%)	172 (50.7%)	70 (58.8%)	540 (44.3%)

Pearson chi2 = 48.09, p<0.001 (adjusted)

It can be seen that, as age increased, a greater percentage of patients died outside of the ICU. This is best demonstrated by comparing the age category of 55-65 (64% of patients died in the ICU, 36% of patients died on the Floor) with the age category of $\geq$85 (41% of patients died in the ICU, 59% of patients died on the Floor). To further examine the relationship of age and location, we fit a logistic regression model that controlled for race, gender, length of stay, and service on which death occurred. Race, gender and length of stay did not confound the relationship and were dropped from the final model. In the final model, the relationship between age and location of death remained statistically significant (p<0.001). Figure 2 pictorially depicts these results.

Figure 2: Relationship between age and location of death.



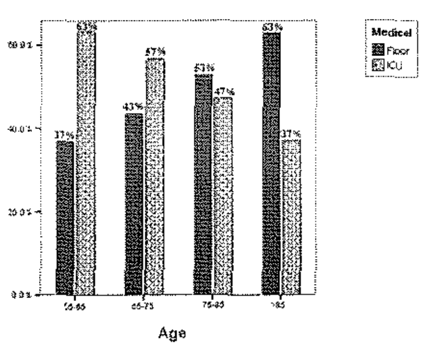
We also examined the relationships between age and location of death for deaths occurring on a medical service and deaths occurring on a surgical service. Table 3 presents this data. Again, as age increased it can be seen that a greater percentage of patients died on the Floor as opposed to the ICU. This occurred in a stepwise fashion across increasing age categories for both services. The difference was most marked for deaths occurring on a medical service, and is best illustrated by comparing the age category of 55-65 (63% ICU, 37% Floor) with the age category of ≥85 (37% ICU, 63% Floor). The relationship between age and location of death for deaths occurring on a medical service remained statistically significant after fitting a logistic regression model that controlled for gender, race and length of stay ($p<0.001$). Table 3 also shows that patients on surgical services tended to die outside of the ICU as age increased. Again, this is illustrated by a comparison of the age category of 55-65 (71% ICU, 29% Floor) with the age category of ≥85 (55% ICU, 45% Floor). Because of the relatively smaller number of patients dying on surgical services, these differences were not statistically significant after controlling for gender, race and length of stay ($p=0.378$). Figure 3 depicts these results pictorially.

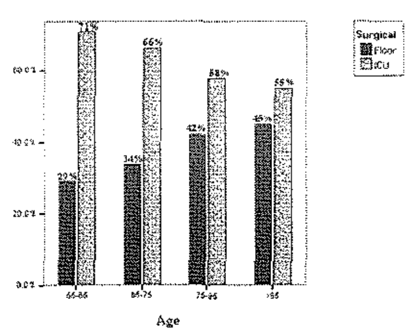
Table 3: Location at the time of death (ICU vs. Floor) for Patients ≥55y at Time of Death, stratified by Service

	Age: 55-65	Age: 65-75	Age: 75-85	Age: >85	Total
Medical	**260 (81.8%)**	**329 (79.3%)**	**267 (80.7%)**	**95 (82.6%)**	**951 (80.7%)**
ICU	164 (63.1%)	186 (56.5%)	125 (47.2%)	35 (37.2%)	510 (53.8%)
Floor	96 (36.9%)	143 (43.5%)	140 (52.8%)	59 (62.8%)	438 (46.2%)
Surgical	**58 (18.2%)**	**86 (20.7%)**	**64 (19.3%)**	**20 (17.4%)**	**228 (19.3%)**
ICU	41 (70.7%)	57 (66.3%)	37 (57.8%)	11 (55.0%)	146 (64.0%)
Floor	17 (29.3%)	29 (33.7%)	27 (42.2%)	9 (45.0%)	82 (36.0%)

For ICU vs. Non-ICU on medical services: $p<0.001$ (adjusted)
For ICU vs. Non-ICU on surgical services: $p=0.378$ (unadjusted)

Figure 3: Relationship between age and location of death, stratified by Service





Relationship Between Age and Length of Stay Before Death

Table 4 presents a summary of length of stay before death for the different age categories. For all patients in this study, the mean length of stay before death was 12.5 days (95% CI 10.1, 14.9).

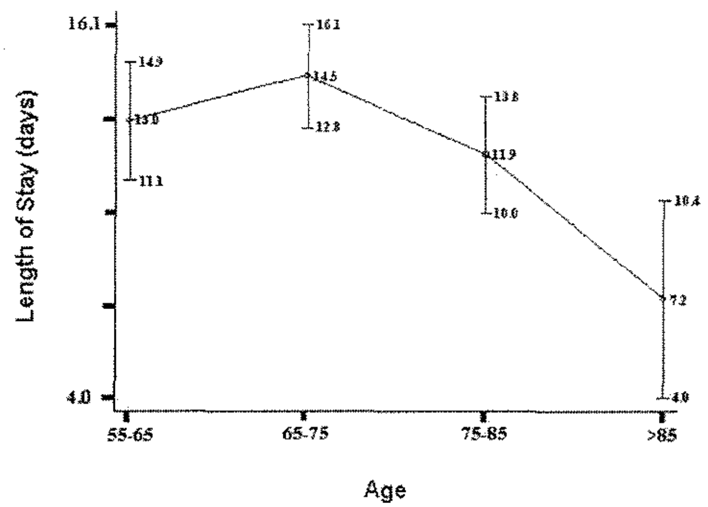
Table 4: Length of Stay (in days) Before Death for Patients $\geq$ 55
*Patients have been excluded who did not die on the floor or in the ICU, or on a medical or surgical service

	Age: 55-65	Age: 65-75	Age: 75-85	Age: >85	Total (55-85+)
Mean (95% CI)	13.0 (11.1, 14.9)	14.5 (12.8, 16.1)	11.9 (10.0, 13.8)	7.2 (4.0, 10.4)	12.5 (10.1, 14.9)

F=5.34, p=0.0012 (adjusted)

While we observed a modest increase in length of stay before death for patients ages 65-75 (x=14.5, 95% CI 12.8, 16.1) as compared with patients ages 55-65 (x=13.0, 95% CI 11.1, 14.9), we found that length of stay before death then decreased for patients ages 75-85 (x=11.9, 95% CI 10.0, 13.8) and then markedly decreased for patients $\geq$85 (x=7.2, 95% CI 4.0, 10.4). We examined the relationship between age and length of stay via a linear regression model controlling for location, service, gender, and race. Gender and race did not confound the relationship and were dropped from the final model. In the final model, the relationship between age and length of stay before death was statistically significant (p=0.0012). Figure 4 displays these results pictorially.

Figure 4: Relationship between age and length of stay before death



Finally, the relationship between age and length of stay was examined for patients dying in the ICU and patients dying outside of the ICU. Table 5 summarizes these results.

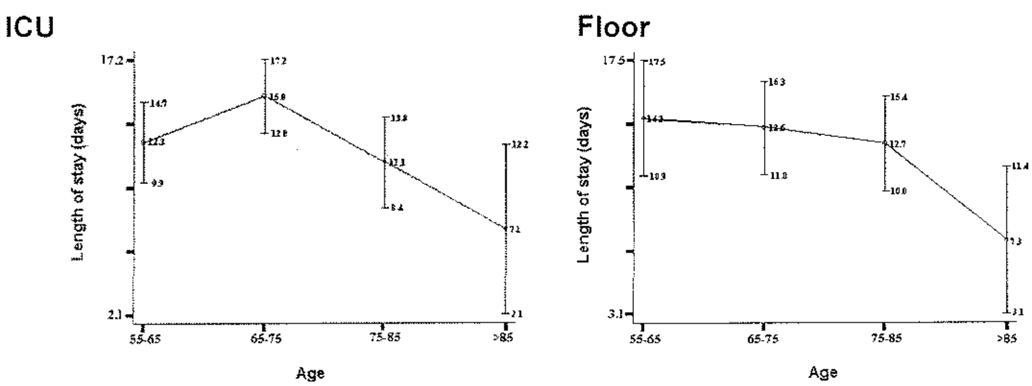
Table 5: Length of Stay (in days) Before Death for Patients ≥ 55, stratified by ICU

	Age: 55-65	Age: 65-75	Age: 75-85	Age: >85	Total
ICU	205 (64.9%)	240 (58.3%)	160 (49.4%)	46 (40.4%)	651 (100%)
Floor	111 (35.1%)	172 (41.7%)	164 (50.6%)	68 (59.6%)	515 (100%)
ICU Mean (95%CI)	12.3 (9.9, 14.7)	15.0 (12.8, 17.2)	11.1 (8.4, 13.8)	7.1 (2.1, 12.2)	12.0 (9.0, 15.0)
Floor Mean (95%CI)	14.2 (10.9, 17.5)	13.6 (11.0, 16.3)	12.7 (10.0, 15.4)	7.3 (3.1, 11.4)	12.9 (10.2, 15.6)

Patients dying in the ICU had a slightly shorter length of stay before death (x=12.0, 95% CI 9.0, 15.0) than patients dying on the Floor (x=12.9, 95% CI 10.2, 15.6). When looking specifically at patients dying in the ICU, we observed a slight increase in length of stay before death when comparing patients ages 55-65 (x=12.3, 95% CI 9.9, 14.7) to patients ages 65-75 (x=15.0, 95% CI 12.8, 17.2) although length of stay then declined substantially for patients ages 75-85 (x=11.1, 95% CI 8.4, 13.8) and even more so for patients ≥85 (x=7.1, 95% CI 2.1, 12.2). We fitted a linear regression model to examine this relationship, including the variables for gender, race, and service. We dropped gender and race from the final model, which showed a statistically significant relationship between length of stay before death and age for patients dying in the ICU ($p=0.02$).

Now looking specifically at patients dying on the Floor, we observed a more gradual decreasing length of stay prior to death across increasing age categories. Patients ages 55-65 had the longest lengths of stay (x=14.2, 95% CI 10.9, 17.5), declining slightly for patients ages 65-75 (x=13.6, 95% CI 11.0, 16.3), decreasing a bit more for patients ages 75-85 (x=12.7, 95% CI 10.0, 15.4) and finally falling off markedly for patients ≥85 (x=7.3, 95% CI 3.1, 11.4). Confidence intervals were widest for the oldest group of patients, reflecting a smaller number of patients and greater variability in length of stay before death for this age group. After fitting a linear regression model including all variables and then dropping gender and race, the final model showed a statistically significant relationship between length of stay before death and age for patients dying on the Floor ($p=0.05$). Figure 5 gives a pictorial depiction of the relationship between age and length of stay for patients dying in the ICU and patients dying outside of the ICU.

Figure 5: Relationship between age and length of stay before death for patients dying in or out of the ICU



DISCUSSION

We found that older patients at one teaching hospital are less likely to die in the ICU than their younger counterparts, even after controlling for baseline demographic characteristics. These trends remain for deaths occurring on medical or surgical services. In addition, older patients have shorter lengths of stay before death at this hospital than younger patients. These trends remain for deaths occurring inside and outside of the ICU. These results suggest that at this teaching hospital, older patients are less likely to receive aggressive interventions and less likely to consume hospital resources at the end of life than younger patients.

This study does have limitations. First, the Decedent Care Database by its nature did not provide information about the number of admissions to the different locations and services for these different age categories of patients. Therefore, while information about death was available, information about survival was not. It is possible that older patients were less likely to die in the ICU than younger patients because older patients were more likely to survive the ICU than younger patients. We also did not have information about transfer of patients to other hospitals or facilities, and we did not know what percentage of all deaths for each age group occurred in the hospital.

Second, this database did not provide information about the underlying diagnoses of the decedents. These diagnoses could potentially confound the relationship between age and location of death, and between age and length of stay before death. If younger patients were more likely to contract diseases requiring more immediate aggressive life-sustaining interventions, this could explain why younger patients were more likely to die in the ICU. In addition, the relatively small age increments (ten years) combined with the dose dependent relationship between age and the dependent variables suggest that the trends observed are more directly a result of age itself and not an additional confounding factor – unless that confounding factor could be expected to demonstrate a similar dose-dependent relationship in ten-year age increments.

Finally, there are limits to the degree to which these results can be generalized. For example, there may be important geographic variations in the care that patients receive at the end of life. The 1999 Dartmouth Atlas report on care at the end of life illustrates some of these differences. It found that the chance that death occurs in association with an admission to intensive care can vary from as much as 29% of all Medicare deaths in New Jersey to only 10.8% of Medicare deaths in Salt Lake City, Utah. The percentage of Medicare patients who spend a week or more in intensive care units during the last six months of life can vary from as much as 23.5% of Medicare deaths in Miami, Florida to only 4.3% of deaths in Portland, Oregon. Even within the same geographic regions, these figures can vary as well.[32] Greater consumption of hospital resources, particularly in the intensive care units, does not necessarily guarantee a proportional increase in quality of life or better outcomes of care.[33] In addition, as mentioned earlier, there may also be differences between teaching hospitals and other types of hospitals in the care provided at the end of life.

With these acknowledged limitations, this study does suggest discrepancies in the amount and intensity of end of life care received by younger and older patients. There are a few possible interpretations of this finding. One interpretation is that perhaps younger patients receive inappropriate aggressive care, and too much care, at the end of life. Under this interpretation, older patients are receiving the appropriate amount and intensity of end of life care, and we ought to adjust the care we give younger patients to mirror the care we give older patients. It is difficult to accept this interpretation, however, because of SUPPORT data showing that doctors frequently underestimate older patients' preferences for life-extending care. It is difficult to surmise that older patients are truly receiving appropriate end-of-life care unless there are some justified explicit criteria used for this care that would contradict patient preferences.

Another interpretation of this finding is that tertiary hospitals are already practicing an implicit form of age-based rationing of hospital care. Such care could result from a misinterpretation of older patients' preferences for end of life care as mentioned. Another potential mechanism could be that older patients are more likely to be transferred to nursing homes where additional care is provided. Indeed, one analysis of SUPPORT data demonstrated that the risk of in-hospital death was decreased in regions with greater nursing home availability.[34] If deaths occur in nursing homes or patient homes instead of hospitals, this may be appropriate or inappropriate. In certain cases these deaths may be appropriate if the use of hospital resources were no longer necessary or helpful and if the nursing home (or better still patient home) represented a more desired place of death. However, such deaths would be inappropriate if they could have been prevented with the use of more intensive interventions of the kind only found in hospitals, if patients desired these interventions. Further research is needed to more closely examine the appropriateness or inappropriateness of hospital care and discharge or transfer for elderly patients at the end of life.

One oft-cited way to control inappropriate aggressive or intensive care at the end of life is the effective use of advance directives. The rationale is simple; patients may decide before the end of life draws near that they do not wish to undergo intensive life-sustaining interventions. If these preferences are communicated clearly to physicians, and these interventions are then withheld, then patients may receive the care they desire. Nevertheless, significant obstacles remain in the way of advance directives acting as an effective vehicle for enhancing the appropriateness of end of life care. First, patients may not be willing to sign such directives. Second, patients may not be willing to forego life-sustaining care when death becomes a near and not an abstract, far-away prospect. Finally, health care systems for a variety of reasons may not effectively implement the directives.[35]

Another possibility for delivering more appropriate end-of-life care is the use of palliative care and hospice care services. Palliative care refers to the "interdisciplinary care of patients and families focused on the relief of suffering and the improvement of quality of life."[36] Hospice care and other hospice-like services focus on the palliation of symptoms rather than necessarily the prevention of death. These services may occur at home but can occur in the hospital as well. Hospital-hospice partnerships are designed for the delivery of coordinated, high-quality palliative care in the hospital setting.[37] As advance directives, palliative care and hospice care become more commonplace in health care, we will be able to observe their effectiveness in improving the appropriateness of end of life care.

REFERENCES

[1] The Henry J Kaiser Family Foundation. Health Care Marketplace: *Wall Street Journal* Examines Physician's Recommendations to Reduce Health Costs. *Kaiser Daily Health Policy Report* Thursday March 21, 2002. (material summarized from the *Wall Street Journal* 3/21/02).

[2] The Henry J Kaiser Family Foundation. Health Issues Expected to be Major Part of 2002 National, State Campaigns. *Kaiser Daily Health Policy Report* Monday, August 5, 2002. (material summarized from the Baltimore *Sun* 8/5/02)

[3] Administration on Aging, US Department of Health and Human Services. A Profile of Older Americans: 2001 (obtained from AOA website).

[4] Alzola C et. al. Length of stay and therapeutic intervention allow estimation of in-hospital resource use independent of site and inflation. *Journal of the American Geriatrics Society.* 2000;48:S162-S167.

[5] Taheri P et. al. Length of stay has minimal impact on the cost of hospital admission. *Journal of the American College of Surgery.* 2000;191:123-130.

[6] Luce J and Rubenfeld G. Can health care costs be reduced by limiting intensive care at the end of life? *American Journal of Respiratory and Critical Care Medicine.* 2002;165:750-754.

[7] Noseworthy T et. al. Cost accounting of adult intensive care: methods and human and capital inputs. *Critical Care Medicine.* 1996;24:1168-1172.

[8] Lubitz J and Riley G. Trends in medicare payments in the last year of life. *New England Journal of Medicine.* 1993;328:1092-1096.

[9] Binstock R. Healthcare costs around the world: is aging a fiscal black hole? *Generations.* 1993;8:37-42.

[10] Luce J and Rubenfeld G. Can health care costs be reduced by limiting intensive care at the end of life? *American Journal of Respiratory and Critical Care Medicine.* 2002;165:750-754.

[11] Bamberger P, Maniscalco-Theberge M et. al. Death and dollars: the cost of dying in the surgical intensive care unit. *The Journal of Truama.* 1996;40:39-41.

[12] Callahan D. Setting limits: medical goals in an aging society. New York, NY: Simon and Schuster, 1987.

[13] Callahan D. Death and the research imperative. *New England Journal of Medicine.* 2000;342:654-656.

[14] Lubitz J and Prihoda R. The use and costs of medicare services in the last two years of life. *Health Care Financing Review.* 1984;5:117-131.

[15] Hamel M et. al. Older age, aggressiveness of care, and survival for seriously ill, hospitalized adults. *Annals of Internal Medicine.* 1999;131:721-728.

[16] Marinella M et. al. Characteristics of centenarians admitted to a community teaching hospital. *Southern Medical Association Journal.* 2002;95:223-224.

[17] Marinella M et. al. Acute care of patients aged 95 to 99 years: experience in a community teaching hospital. *Southern Medical Journal.* 2000;93:677-680.

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[18] Keenan S et. al. Intensive care unit admission has minimal impact on long-term mortality. *Critical Care Medicine.* 2002;30:501-507.

[19] Yu W et. al. Intensive care unit use and mortality in the elderly. *Journal of General Internal Medicine.* 2000;15:97-102.

[20] Kass J et. al. Intensive care unit outcome in the very elderly. *Critical Care Medicine.* 1992;20:1666-71.

[21] Rockwood K et. al. One-year outcome of elderly and young patients admitted to intensive care units. *Critical Care Medicine.* 1993;21:687-691.

[22] Lynn J et. al. Prognoses of seriously ill hospitalized patients on the days before death: implications for patient care and public policy. *New Horizons.* 1997;5:56-61.

[23] Fox E et. al. Evaluation of prognostic criteria for determining hospice eligibility in patients with advanced lung, heart, or liver disease. *JAMA.* 1999;282:1638-1645.

[24] Levinsky N et. al. Patterns of use of common major procedures in medical care of older adults. *Journal of the American Geriatrics Society.* 1999;47:553-558.

[25] Levinsky N et. al. Influence of age on medicare expenditures and medical care in the last year of life. *Journal of the American Medical Association.* 2001;286:1349-1355.

[26] Hamel M et. al. Seriously ill hospitalized adults: do we spend less on older patients? *Journal of the American Geriatric Society.* 1996;44:1043-1048.

[27] Perls T and Wood E. Acute care costs of the oldest old. *Archives of Internal Medicine.* 1996;156:754-760.

[28] Perls T. The oldest old. *Scientific American.* 1995;January:70-75.

[29] Hakim R et. al. Factors associated with Do-Not-Resuscitate orders: patients' preferences, prognoses, and physicans' judgments. *Annals of Internal Medicine.* 1996;125:284-293.

[30] Taylor D et. al. Effects of admission to a teaching hospital on the cost and quality of care for medicare beneficiaries. *New England Journal of Medicine.* 1999;340:293-299.

[31] Yuan Z et. al. The association between hospital type and mortality and length of stay: a study of 16.9 million hospitalized medicare beneficiaries. *Medical Care.* 2000;38:231-245.

[32] The Dartmouth Atlas. Variations in End of Life Care: An End of Life Quick Report. Compiled from The Dartmouth Atlas of Health Care 1999.

[33] Wennberg J. The Dartmouth Atlas Report: Future Challenges of End of Life Care. Speech given at the Center to Advance Palliative Care (CAPC) Palliative Care Fall Forum, December 4, 2000.

[34] Pritchard R et. al. Influence of patient preferences and local health system characteristics on the place of death. *Journal of the American Geriatrics Society.* 1998;46:1242-1250.

[35] Institute of Medicine. Approaching Death: Improving Care at the End of Life. Washington DC: National Academy Press, 1997.

[36] Von Gunten C. Secondary and tertiary palliative care in US Hospitals. *Journal of the American Medical Association.* 2002;287:875-881.

[37] National Hospice and Palliative Care Organization (NHPCO) and the Center to Advance Palliative Care in Hospitals and Health Systems (CAPC). Hospital-Hospice Partnerships in Palliative Care: Creating a Continuum of Service. 2002.