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Relationship Between Quality of Care for Hospitalized Vulnerable Elders and Post-Discharge Mortality

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Abstract

Objectives—To assess the relationship between quality of hospital care, as measured by ACOVE quality indicators, and post-discharge mortality for hospitalized seniors.

Design—Observational cohort study

Setting—Single academic medical center

Participants—Patients age 65 and over who were identified as “vulnerable” using the Vulnerable Elder Survey (VES-13)

Measurements—Adherence to 16 ACOVE measures through chart audit; Post-discharge mortality obtained through Social Security Death Index

Results—856 inpatient vulnerable elders were enrolled. Mean quality of care score was 59.5% (SD 19.2) and 495 (26.7%) died within one year of discharge. In multivariate logistic regression, controlling for sociodemographic and disease severity variables (Charlson comorbidity score, VES-13 score, number of quality indicators triggered, length of stay, baseline ADL limitations, code status), higher quality of care appeared to be associated with a lower risk of death at one year. For each 10% increase in quality score, patients were 7% less likely to die [OR 0.93 (0.87-1.00), $p=0.045$]. In Cox proportional hazard models, those hospitalized patients receiving quality of care better than the median quality score were less likely to die 1 year period post-discharge [HR 0.82, 95% CI (0.68-1.00), $p=0.05$]. Those patients that received a nutritional status assessment were less likely to die one year after discharge [HR 0.61, 95% CI (0.40-0.93), $p=0.022$].

Conclusion—Higher quality of care for hospitalized seniors, as measured by ACOVE measures, may be associated with a lower likelihood of death 1 year after discharge. Given these findings, future work testing interventions to improve adherence to these quality indicators is warranted.

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Keywords

vulnerable elder; quality measures; mortality

INTRODUCTION

There is great interest in improving quality of care for hospitalized seniors. There are several reasons for this: Hospitalized older patients are generally sicker, have more comorbidities, and may have different health care goals and preferences than younger adults. Thus, they require different processes of health care than their younger counterparts. Moreover, older hospitalized patients are at greater risk for the “hazards of hospitalization,” or increased predisposition to geriatrics-specific conditions such as delirium or pressure ulcers associated with hospitalization itself. In addition, roughly one quarter of hospitalized older patients will die one year after discharge.³

To assist in measuring quality of care for older patients, the Assessing Care of Vulnerable Elders (ACOVE) quality indicators are a set of IF/THEN statements that were developed as a standardized geriatric-specific quality measures.⁴ Prior research using the ACOVE process measures has demonstrated that geriatric-specific quality indicators have a significantly lower adherence rate than general medicine quality indicators.⁵ In addition, greater adherence to the ACOVE measures already has been shown to be correlated with decreased patient mortality among community-dwelling elders.⁶ However, the relationship between ACOVE measures and mortality for hospitalized older patients is unknown. The aim of this study is to assess the relationship between quality of hospital care, as measured by ACOVE quality indicators, and mortality in the year following hospital discharge for older adults admitted to a general medicine service.

METHODS

Patient Population

Subjects for this study were recruited from an ongoing study of patients admitted to the general medicine inpatient service at the University of Chicago Medical Center from May 2004 through June 2007.⁷ New adult patients age 65 and older were approached shortly after admission by trained research assistants, who, upon receiving the patient’s consent to participate in the study, administered the Vulnerable Elders Survey (VES-13).⁸ The purpose of the VES-13 is to quickly identify older patients at higher risk for functional decline and death, using simple criteria such as age, self-reported health, and functional limitation with a series of specific physical activities. The VES-13 score ranges from 1 to 10 (higher score indicates worse prognosis) with a score of 3 or higher identifying an individual as vulnerable. The ACOVE quality indicators were explicitly developed to apply to patients over age 65 identified as vulnerable using this screening method.⁴ Thus, all consenting patients who scored 3 or higher on the VES-13, and identified as vulnerable elders, and who survived to discharge were included in this study. All patients who were discharged to hospice or comfort care, and thus for whom death was an expected outcome, were also excluded. Other exclusion criteria included patients whose length of hospital stay was one day or less, as quality of care would have less impact on outcomes within such a short period of time, or patients who were readmitted within 30 days. Finally, all patients who were transferred from an ICU (Intensive Care Unit) to the general medicine inpatient service were excluded from the study, due to their implicitly high severity of disease and consequent potential for adverse outcomes unrelated to quality of care on the general medicine service. This study was approved by the University of Chicago Institutional Review Board and participants were asked to provide written consent for this study.

Data Collection

Inpatient interview—During the initial inpatient interview, research assistants collected demographic information, including such variables as age, race, education level, household income, marital status, and residence. Additionally during this interview, an abbreviated form of the Mini-Mental State Exam (MMSE) was administered. For those who scored less than a 17 out of a possible 22, a proxy was identified to complete the consent process and inpatient interview for the patient.⁹ Finally, research assistants also collected information about the patient's current functional limitations in each of the six ADLs (Activities of Daily Living): bathing, dressing, feeding, transferring, toileting, and continence. ¹⁰ Patients were explicitly asked to report if they felt limited in these activities at the time of admission. ¹¹ Baseline ADL limitations ranged from 0 to 6 with higher score meaning a patient had more ADL limitations.

Quality of care assessment—Medical charts of patients enrolled in the study were reviewed after patient discharge by research assistants who had undergone training and supervised review of 25 charts. Quality of care was assessed using ACOVE quality indicators, as previously adapted for hospitalized seniors by researchers at the University of Chicago.¹² Six of these quality indicators (effort to improve mobility, discharge planning, and assessment of cognitive status, functional status, nutritional status, and pain) were abstracted from the charts of all vulnerable elder patients. An additional eleven condition-specific quality indicators were only abstracted for seniors with documentation of the condition in question (i.e. delirium and pressure ulcers). Inter rater reliability and validity of their abstraction has been confirmed¹².

Mortality data—Patient death dates were determined using the Social Security Death Index (SSDI).¹³ Due to hospital privacy policies, full Social Security numbers were not available for definitive matching of patients to death records. Instead, matches were made based on a matching algorithm using first and last name, date of birth, zip code, and final four digits of the patient's Social Security number.¹⁴ Time to death after discharge was then calculated by subtracting the discharge date in the patient's chart from the date of death listed in the SSDI.

Because patient illness and physical function can dramatically affect patient outcomes regardless of quality of care delivered, seven different markers of patient illness were used in this study in order to adjust for this factor. Three of these (age, VES-13 score, and number of ADL limitations) were ascertained upon patient recruitment to the study as part of the initial self-report survey. Additional measures that reflected patient illness (length of hospital stay, number of quality indicators for which a patient was eligible, and Do Not Resuscitate/Do Not Intubate status) were all assessed as part of the chart abstraction. Because many of the ACOVE quality indicators are condition-specific, the number of quality indicators for which a patient was eligible was used as a proxy for the number of geriatric-specific conditions affecting the patient, thus indicating the patient's relative severity of illness.¹⁵ We also adjusted for the Charlson comorbidity score, a clinical comorbidity index that was derived for each patient based on administrative diagnostic coding performed for billing purposes.¹⁶ Lastly, we also controlled for DNR/DNI status. Although a treatment preference, we hypothesized that those patients with DNR/DNI order would be more likely to be near the end of life and die after hospitalization.

Statistical Analysis

Adherence to ACOVE quality indicators was determined using a composite quality score, derived for each individual patient from the percentage of quality indicators triggered that were actually met and using only those quality indicators for which the patient was eligible.⁶

Multivariate logistic regression was used to assess the effect of quality score on post-discharge mortality (separate models were performed for 30 days, 60 days, 90 days, and 1 year after discharge). Prior to performing this test, all quality scores were divided by 10 in order to produce more clinically meaningful results in logistic regression (odds ratio = relative odds of death for every 10% increase in composite quality score). All models controlled for demographic factors such as age, sex, race, and marital status, as well as for covariates to reflect patient illness such as VES-13 score, DNR/DNI status, Charlson comorbidity score, number of baseline ADL limitations, length of stay, and number of quality indicators triggered. Additionally, all models were clustered by attending physician to mitigate unmeasured physician effects. We also assessed the importance of potential multicollinearity by performing correlation between these measures and assessing the robustness of our results to alternative specifications that include only one or the other.

Additionally, a Cox proportional hazards regression was used to determine differential 1-year survival rates between patients receiving care above and below the median quality score. This model was adjusted for the same set of demographics and disease severity variables as the multivariate logistic regression and was also similarly clustered by attending physician. All statistical analysis was performed using Stata 10.0 (Stata Corp., College Station, TX).

RESULTS

From May 2004 through June 2007, 6392 patients over age 65 were admitted to the general medicine inpatient service at the University of Chicago Medical Center (Figure 1). Of the 5278 (82.6%) who stayed in the hospital more than 1 day, 3633 (68.8%) consented to participate in the study. 2040 (56.2%) of the consenting patients were identified as vulnerable elders through administration of the VES-13, of whom 46 (2.3%) died in the hospital, 65 (3.2%) were discharged to hospice or comfort care only, and 68 (3.3%) were transferred from an ICU. Of the remaining patients, 1856 (99.7%) had medical charts available for review, all of which received full chart audits.

The majority of patients in this study were single female African-Americans, with a mean age of 79.7 (Table 1). Upon admission to the hospital, these patients were assessed to have a mean VES-13 score of 5.8 and a mean number of ADL limitations of 4.2. 5.7% of patients (106) demonstrated cognitive impairment, defined as a score of 17 or less on an abbreviated 22-point MMSE, and thus required the use of a proxy to perform the initial interview.⁹ The patients enrolled in this study stayed in the hospital for a mean of 5.9 days. Chart audits following discharge demonstrated that the patients' mean Charlson comorbidity score was 1.9 and that 177 (9.5%) of these patients had a DNR/DNI order present.

The patients included in this study triggered a mean of 8.3 quality indicators (standard deviation 2.0). Quality of care delivered, calculated as percent adherence to all quality indicators triggered, had a mean value of 59.3% (standard deviation 19.2). Median quality score was 62.5 with IQR (50, 71.4). 114 (6.1%) patients died within 30 days of discharge from the hospital, 191 (10.3%) died within 60 days, 246 (13.3%) died within 90 days, and 495 (26.7%) died within 1 year (Table 2).

Multivariate logistic regression, adjusting for a series of demographic, disease severity, and other variables, was used to test the relationship between 10 percent change in quality score and death within each of these four time periods. All four tests produced odds ratios of less than 1 (Table 2). However, this relationship achieved significance in July in only two time frames: the 60 day period and the 1 year period ($p < 0.05$). The odds ratios produced were 0.90 for the 60 day period and 0.93 for the 1 year period; in other words, for every 10%

increase in quality score, the odds of death within 60 days and 1 year after discharge decreased by 10% and 7%, respectively. Additionally, the association between composite quality score and mortality did not vary when incorporating interactions between quality score and covariates (i.e. gender, comorbidity score, baseline ADL limitations or length of stay.)

The patient population of this study was then split into two groups, those who received quality of care above and below the median quality score of 62.5%, for the purpose of the Cox proportional hazards regression model. This model was used to test the differential 1 year survival of the two groups, after adjusting for the same demographic and disease severity variables adjusted for in the multivariate logistic regression. As shown in Figure 2, patients receiving quality of care better than the median quality score experienced greater survival over the course of the 1 year period post-discharge. The hazards ratio for this relationship was 0.82, indicating that those receiving better quality care were 18% less likely to die within 1 year. This outcome was statistically significant ($p=0.05$).

The relationships between patient mortality and the demographic and disease severity covariates derived from this 1 year Cox proportional hazards regression are shown in Table 3. While most of the demographic covariates showed no significant relationships with mortality, a significant relationship did exist for females, who were 49% more likely to die within 1 year than males ($p<0.001$). All patient illness covariates were significantly associated with a hazards ratio of greater than 1, indicating an increased likelihood of death ($p<0.05$). Thus, as expected, sicker patients (identified as those who had a higher VES-13 score, who suffered more comorbidities, who triggered more quality indicators, who stayed in the hospital longer, or who were more limited in ADLs at the time of admission) were more likely to die within 1 year. In addition, those with DNR/DNI orders were also more likely to die 1 year after discharge. All results of these regression models were robust against additional analyses controlling for education level, impaired cognitive status, discharge to rehabilitation or nursing home, and specific individual ADL limitations.

We also undertook additional analyses to examine whether patients with higher than median quality of care differed from those that had lower than median quality of care. In univariate analyses, patients with a longer length of stay and that triggered more quality indicators were more likely to receive above the median quality score (LOS 6.48 days for those above median quality score vs. 5.51 days below median quality score; $p=0.012$; 8.50 mean QIs triggered above median quality score vs. 8.06 QIs triggered below median quality score; $p<0.001$). These associations remained significant in multivariate analyses controlling for other covariates.

Additional Cox proportional hazards regression tests were performed to examine the relationship between specific quality indicators and post-discharge mortality. Only the six universally triggered quality indicators were tested in these regression models, as these quality indicators applied to all patients in this study. The only quality indicator to reach significance was nutritional status assessment. The hazards ratio for the relationship between nutritional status screening and mortality was 0.61, indicating that assessment of nutritional status was associated with a 39% decrease in patient mortality within 1 year after discharge ($p=0.022$).

DISCUSSION

Our results demonstrate that better quality of care, measured using ACOVE quality indicators, may be associated with lower post-discharge mortality for hospitalized vulnerable elders. Our findings are consistent with prior work demonstrating a similar

quality-survival relationship in community-dwelling vulnerable elders.⁶ Similar to our study, Higashi et al. found that the most significant relationship between quality of care and mortality occurred at more delayed (greater than 500 days) rather than more immediate time frames.

Given these findings, it is important to thoroughly explore the possible mechanisms for these findings. One possibility is that better quality of care directly improves patient survival, which would provide a strong argument for improving care processes for hospitalized seniors that are emphasized in ACOVE quality indicators. However, because this is an observational study, it is important to entertain other explanations. For example, it is also possible that hospitalized older patients who have longer life expectancies receive better quality care. For this to hold true, doctors would have to preferentially provide certain care processes, such as nutritional status assessment or mobility plans, to those hospitalized patients who are expected to live longer than to patients who are expected to die. However, studies suggest that physicians do not accurately predict patient prognosis during the hospitalization and provide more aggressive care to all except those who have a priori preferences for less aggressive care.¹⁷ In fact, several recent studies highlight that that sicker patients actually tend to receive more attention and care from medical personnel.^{18-19, 20, 21} Likewise, our study also shows that patients who receive higher than median quality scores triggered more quality indicators, and hence had more geriatric conditions, and also stayed longer in the hospital.

Another possible explanation for these results is that the receipt of certain care processes could be associated with some other variable that is related to improved survival. For example, in this study, adherence to nutritional status is highly correlated with overall quality score ($r=0.69$). Additionally, adherence to cognitive screening, functional screening, and early discharge planning were all significantly associated with nutritional status assessment, further demonstrating that patients who received nutritional status assessment were more likely to receive higher quality of care. Documentation of nutritional status is also likely correlated with receipt of nutritional supplementation, which could result in improved outcomes. Although it is unclear whether nutritional supplementation improves survival in hospitalized patients, at least one randomized controlled trial has confirmed that nutritional supplementation in hospitalized elderly patients resulted in reduced readmission 6 months post-discharge.²²⁻²³ Future research that aims to establish a causal relationship between adherence to ACOVE quality measures and post-discharge survival is warranted.

In addition to the observational design, other limitations of this study include the possibility of other unmeasured factors driving the effect on mortality. Additionally, this study was performed at only one institution, with a predominantly African American female patient population, and thus the results may not be able to be generalized. In addition, we had a low incidence of patients with cognitive impairment likely reflecting the difficulty enrolling patients and their proxies into this study. Likewise, because we have no information on patients that did not consent, it is possible that our patients differed in other ways from nonresponders. Previous research has also shown that chart abstraction underestimates true quality of care, so the quality scores calculated here may be an inaccurate representation of the quality of care that the patients actually received.²⁴ Finally, while this study evaluates mortality as a patient outcome, mortality may not be the most relevant outcome for older patients, who often value quality of life over length of life.

In conclusion, this study adds to existing literature on the link between quality of care and survival in finding that improved quality of care for hospitalized vulnerable elders, as measured by ACOVE quality indicators, may be associated with lower rates of post-discharge mortality. While causality cannot be assumed here, the potential importance of

such a mortality benefit indicates that future research is needed to establish the mechanism driving this relationship.

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APPENDIX

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Quality Indicator	Number Eligible	% Passed	95% CI
If a vulnerable elder is admitted to the hospital for any acute or chronic illness or any surgical procedure, THEN the evaluation should include, within 24 hours, cognitive status.	1856	0.04	(0.03 -0.05)
If a vulnerable elder is admitted to a hospital or is new to a physician practice, THEN assessment of functional status should be documented.	1856	0.42	(0.40-0.44)
IF a vulnerable elder is found to have problems with gait, strength, or endurance, THEN an exercise program should be offered.	1767	0.69	(0.67-0.71)
If a vulnerable elder is admitted to the hospital, THEN the discharge planning should begin within 48 hours.	1855	0.86	(0.84-0.87)
IF a hospitalized vulnerable elder is at very high risk for venous thrombosis, THEN the patient should have venous thromboembolism prophylaxis.	1302	0.88	(0.86-0.90)
IF a vulnerable elder is hospitalized, THEN his or her nutritional status should be documented during the hospitalization by evaluation of oral intake or serum biochemical testing.	1856	0.94	(0.93-0.95)
IF a vulnerable elder has dementia, THEN he or she should be screened for depression during the initial evaluation.	452	0.19	(0.15-0.22)
IF a hospitalized elder has a definite or suspected diagnosis of delirium, THEN an evaluation for potentially precipitating factors must be undertaken and identified causes treated.	413	0.42	(0.37-0.46)

Quality Indicator	Number Eligible	% Passed	95% CI
IF a vulnerable elder with dementia is to be physically restrained in the hospital, THEN the target behavioral disturbance or safety issue justifying use of the restraints must be identified to the consenting person and documented in the chart.	53	0.96	(0.91-1.02)
IF a vulnerable elder is physically restrained and the target behavioral disturbance requiring restraint is identified, THEN the health care team should include methods other than physical restraints in the care plan.	51	0.73	(0.60-0.85)
IF a vulnerable elder is admitted to an intensive care unit or a medical or surgical unit of a hospital and cannot reposition himself or herself or has limited ability to do so, THEN risk assessment for pressure ulcers should be done on admission	804	1.00	(0.99-1.00)
IF a vulnerable elder presents with a pressure ulcer, THEN the pressure ulcer should be assessed for location, depth and stage, size, and the presence of necrotic tissue.	305	0.00	(0.00-0.01)
IF a vulnerable elder presents with a full-thickness sacral or trochanteric pressure ulcer covered with necrotic debris or eschar, THEN debridement by using sharp, mechanical, enzymatic, or autolytic procedures should be done within 3 days of diagnosis.	8	1.00	(1.00-1.00)
IF a vulnerable elder has a stage 2 or greater pressure ulcer, THEN a topical antiseptic should not be used on the wound.	178	0.72	(0.66-0.79)
IF a vulnerable elder presents with a clean full-thickness or a partial-thickness pressure ulcer, THEN a moist wound-healing environment should be provided with topical dressings.	45	0.84	(0.73-0.95)
IF patient has an indwelling catheter placed either on admission or during hospitalization THEN there should be documented indication of need for catheter that corresponds to an appropriate indication	723	0.59	(0.55-0.63)
ALL vulnerable elders should be screened for chronic pain during the initial evaluation period.	1856	0.55	(0.52-0.57)

CI = confidence interval

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Figure 1.
Patient Recruitment to and Exclusion From Study.
*VES-13, 13-item Vulnerable Elders Survey
†ICU, Intensive Care Unit

Figure 2.

Cox proportional hazards regression model of survival of patients above and below median quality score. †

*Adjusted for race, gender, age, marital status, VES-13 score, DNR/DNI status, Charlson comorbidity score, number of quality indicators triggered, length of hospital stay, and number of baseline ADL limitations

†Quality score calculated as percent of quality indicators triggered that were actually met

Table 1

Characteristics of Study Population (n = 1856).

Characteristic	n (%) *
Age in years, mean (SD)	79.8 (8.3)
Female	1281 (69.1)
African-American	1355 (73.0)
Hispanic	50 (2.7)
Income:	
Household income <\$15,000/year	379 (20.4)
Household income >\$15,000/year	280 (15.1)
Unknown	1197 (64.5)
Education:	
High school or less	1053 (56.7)
Some college or more	546 (29.4)
Unknown	257 (13.9)
Residence:	
Lives at home	1545 (83.2)
Lives in nursing home, group home, or long-term care facility	223 (12.0)
Unknown	88 (4.7)
Marital status:	
Single †	1311 (70.6)
Married or living as if married	450 (24.2)
Unknown	95 (5.1)
VES-13‡ score, mean (SD)	5.8 (2.1)
Length of hospital stay in days, mean (SD)	5.9 (9.0)
Number of ADL limitations §, mean (SD)	2.7 (2.7)
Impaired cognitive status ¶	106 (5.7)
Charlson comorbidity score, mean (SD)	1.9 (1.6)
DNR/DNI# order present	177 (9.5)
Discharged to rehabilitation or nursing home	521 (28.1)

* Except where noted

† Includes divorced, separated, and widowed

‡ VES-13, 13-item Vulnerable Elders Survey, scored 0-13

§ ADL, Activities of Daily Living, as reported upon admission to hospital

¶ Score of less than 17 out of a total of 22 on abbreviated Mini-Mental State Exam (MMSE)

DNR/DNI, Do Not Resuscitate/Do Not Intubate

Table 2

Relationship Between 10% Change in Composite Quality Score and Post-Discharge Patient Mortality (n = 1856).

Time period post-discharge	Number of patients who died (%)	Odds ratio (95% confidence interval) [†]	p value
30 days	114 (6.1)	0.88 (0.76-1.02)	0.083
60 days	191 (10.3)	0.90 (0.81-1.00)	0.050
90 days	246 (13.3)	0.94 (0.86-1.04)	0.223
1 year	495 (26.7)	0.93 (0.87-1.00)	0.045

* Quality of care calculated as percent of quality indicators triggered that were actually met, divided by 10. Therefore, for ease of interpretation, odds ratios reflect the odds of death for each 10% increase in quality score.

[†] Derived from multivariate logistic regression analysis, adjusting for race, gender, age, marital status, VES-13 score, DNR/DNI status, Charlson comorbidity score, number of quality indicators triggered, length of hospital stay, and number of baseline ADL limitations

Table 3

Relationship Between Covariates and Post-Discharge Patient Mortality at One Year (n = 1856).

Predictor variable	Hazards ratio [*] (95% confidence interval)	p value
African-American	0.92 (0.72-1.18)	0.530
Female	1.49 (1.22-1.84)	<0.001
Average age	1.01 (1.00-1.03)	0.052
Married	1.02 (0.79-1.31)	0.875
Average VES-13 [†] score	1.09 (1.04-1.15)	<0.001
DNR/DNI [‡] , status	1.89 (1.41-2.54)	<0.001
Charlson comorbidity score	1.10 (1.04-1.17)	0.002
Number of quality indicators triggered	1.06 (1.00-1.12)	0.036
Length of stay [§]	1.40 (1.25-1.58)	<0.001
Number of ADL [¶] limitations at admission	1.07 (1.03-1.12)	0.001

^{*} Derived from Cox proportional hazards regression model testing the relationship between predictor variables and post-discharge patient mortality

[†] VES-13, 13-item Vulnerable Elders Survey, scored 0-13

[‡] ,DNR/DNI, Do Not Resuscitate/Do Not Intubate

[§] Adjusted for as log(length of stay)

[¶] ADL, Activities of Daily Living, as reported upon admission to hospital