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Predictors of In-Hospital Mortality among Hospitalized Nursing Home Residents: An Analysis of the National Hospital Discharge Surveys 2005–2006

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Abstract

Objective—To determine the demographic and clinical predictors of in-hospital mortality among hospitalized nursing home (NH) residents.

Design—Retrospective analysis of the public-use copies of the 2005–2006 National Hospital Discharge Survey (NHDS) datasets.

Setting—Non-federal acute-care, short-stay hospitals in all 50 states and the District of Colombia.

Participants—1904 and 1752 NH residents, ≥45 years, hospitalized in 2005 and 2006, respectively.

Measurements—In-hospital mortality.

Methods—A multivariable logistic regression model was developed to determine independent predictors of in-hospital mortality using the 2005 dataset. The model was then applied to the 2006 dataset to determine the generalizability of the predictors.

Results—Significant independent predictors of in-hospital mortality in 2005 included ≥85 years (adjusted odds ratio {OR}, 2.53; 95% confidence interval {CI}, 1.21–5.30; P=0.013), acute respiratory failure (adjusted OR, 5.67; 95% CI, 3.51–9.17; P<0.0001), septicemia (adjusted OR, 4.63; 95% CI, 3.08–6.96; P<0.0001) and acute renal failure (adjusted OR, 2.11; 95% CI, 1.30–3.41; P=0.002). These baseline characteristics also predicted in-hospital mortality in 2006: age ≥85 years (adjusted OR, 2.45; 95% CI, 1.31–4.59.30; P=0.005), acute respiratory failure (adjusted OR, 7.11; 95% CI, 4.46–11.33; P<0.0001), septicemia (adjusted OR, 3.91; 95% CI, 2.64–5.80; P<0.0001) and acute renal failure (adjusted OR, 2.75; 95% CI, 1.82–4.15; P<0.0001). Chronic morbidities were not associated with in-hospital mortality.

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Conclusion—In hospitalized NH residents, age ≥ 85 years and several acute conditions, but not chronic morbidities, predicted in-hospital mortality. Elderly NH residents at risk of developing these acute conditions may benefit from palliative care.

Keywords

nursing home; hospitalization; in-hospital mortality

Introduction

Most nursing home (NH) residents are older adults who suffer from multiple disabilities and chronic morbidities with frequent acute exacerbations, often requiring hospitalization.¹⁻³ NH residents also often receive poor quality of care and are at risk for adverse outcomes during hospitalization.^{4, 5} However, little is known about the predictors of in-hospital mortality for hospitalized NH residents. The objective of this study was to identify baseline demographic and clinical characteristics that would predict in-hospital mortality in a national sample of NH residents, hospitalized in the United States by analyzing the 2005 and 2006 National Hospital Discharge Survey (NHDS) datasets.

Methods

Data Source and Patients

The NHDS is a continuous survey of inpatient utilization of short-stay hospitals in the United States.^{6, 7} The NHDS is based on data abstracted from medical records of patients discharged from a national sample of non-Federal short-stay hospitals in all 50 states and Washington D.C. The National Center for Health Statistics has been collecting NHDS data annually since 1965. The NHDS datasets can be found in the public domain at the Center for Disease Control and Prevention website. Hospitals included in the NHDS data are those with six or more beds and an average length of stay for all patients of less than 30 days. The NHDS employs a complex probability design to guarantee that the nation is represented properly. For the purpose of the current analysis, we chose the two most recent years of data available, the 2005 and the 2006 NHDS datasets.^{8, 9}

The current analysis was approved by the Chair of the Math and Science Department of the Alabama School of Fine Arts and the Institutional Review Board of the University of Alabama at Birmingham. Data files were downloaded in an Acronym for the American Standard Code for Information Interchange (ASCII) format from the Center for Disease Control website (<http://www.cdc.gov/nchs/about/major/hdasd/nhds.htm>). Using instructions from a data dictionary, which was downloaded separately and an SPSS 12 statistical software program, we then converted data from the ASCII plain text file to a readable SPSS data file (SPSS Inc. Chicago, IL).

The study cohort was obtained by identifying all patients whose residence before hospital admission was a NH. Of the 375,372 patients in the 2005 NHDS dataset, 1904 (0.5%) were admitted from a NH and of the 376,328 patients in the 2006 NHDS, 1752 (0.5%) were admitted from a NH (Figure 1). The population was then restricted to patients age 45 years and older. This restriction was set in place because there were few patients below the age of 45, and was not expected to be representative of the typical NH population.

The NHDS data is suitable for the current study because it has data on source of admission and discharge disposition, which allows for the identification of patients who were NH residents before hospital admission and those who died during hospitalization, respectively. Other variables in the NHDS dataset include age, sex, race, marital status, primary discharge

diagnosis, hospital bed size, region, and ownership, type of hospital admission, source of payment, discharge month, and length of stay. The given variables were used to create multiple dummy variables to be used for analytical purposes. For example, the dummy variable Medicare was created from the variable source of payment. The International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) was used to define all medical diagnoses and surgical procedures (Box 1). The ICD-9 codes were also used to define the top ten primary discharge diagnoses.

Statistical Analysis

We began by comparing baseline characteristics of NH residents from the 2005 and the 2006 NHDS datasets and tested for statistical significance by using Chi-square test and student t-test for categorical and continuous variables, respectively (Table 1). Then we identified the top ten ICD-9 codes for primary discharge diagnoses separately for each year's cohort and presented their frequency distributions (Table 2).

We developed a multivariable logistic regression model to determine the predictors of inhospital mortality among hospitalized NH resident in the 2005 dataset. In the model, in-hospital mortality was the dependent variable and various baseline characteristics were entered as covariates. Covariates entered into the model included chronic comorbidities (coronary artery disease, hypertension, dementia, depression, chronic heart failure, and chronic obstructive pulmonary disease) and acute conditions (acute heart failure, acute myocardial infarction, pneumonia, volume depletion and electrolyte imbalances, septicemia, acute renal failure, and acute respiratory failure), hospital length of stay 6 days or longer, hospital bed size less than 200, and emergency hospital admission. These covariates were selected based on their known clinically relevant prognostic importance. Except for race, all other covariates had a significant ($P < 0.10$) bivariate associations with in-hospital mortality. However, we chose not to use bivariate significance as the basis of covariate selection as that approach may potentially reject otherwise prognostically important covariates.¹⁰ We forced age, sex and race into the model, and entered other covariates in a forward stepwise method. Age was categorized into four groups, <65 years, 65-74 years, 75-84 years, and ≥ 85 years. Age categories 65-74 years, 75-84 years, and ≥ 85 years were used as dummy variables with age <65 years as the reference category. A Hosmer and Lemeshow Goodness-of-Fit test P value of 0.683 suggested that model's estimates fit the data at an acceptable level. A Hosmer and Lemeshow Goodness-of-Fit test $P < 0.05$ would suggest a poor fit, that is, a significant difference between the observed and predicted values of the dependent variable. An area under a receiver operating characteristic (ROC) curve of 0.78 indicated that the model had a reasonably good discrimination power to differentiate between patients with and without in-hospital mortality.

To determine if the predictors of in-hospital mortality in the 2005 cohort could also predict in-hospital mortality in the 2006 cohort, we ran the 2005 model in the 2006 NHDS dataset. All statistical tests were evaluated using a 2-tailed 95% confidence level and p values < 0.05 were considered statistically significant. All data were analyzed using SPSS for Windows version 12 (SPSS Inc. Chicago, IL).

Results

Patient Characteristics

Patients in the 2005 cohort (N=1904) had a mean ($\pm$ SD) age of 78.6 (± 11.4) years, 63% were women and 15% were African Americans. Those in the 2006 cohort (N=1752) had a mean ($\pm$ SD) age of 78.2 (± 11.7) years, 62% were women and 16% were African Americans. Baseline characteristics of patients in both cohorts are displayed in Table 1. The prevalence of coronary artery disease and dementia was higher in the 2005 cohort and the prevalence acute renal failure

was higher in the 2006 cohort (Table 1). The prevalence of Medicaid use and emergency admission were also higher in the 2006 cohort.

Top Ten Primary Discharge Diagnoses

Overall, there were 466 and 434 primary discharge diagnoses (based on ICD-9 codes) among the 1904 and 1752 hospitalized NH residents in 2005 and 2006 cohorts respectively. Of these, the top ten primary discharge diagnoses represented 38% and 37% of all primary discharge diagnoses in 2005 and 2006 respectively. With a prevalence of 6%, pneumonia was the leading primary discharge diagnosis in both 2005 and 2006 (Table 2). Heart failure was the third leading primary discharge diagnosis in 2005 (prevalence, 5%) but moved to the fifth position in 2006 (prevalence, 4%). Nine of the top ten primary discharge diagnoses in 2005 were also listed among the top ten primary discharge diagnoses in 2006. However, the primary discharge diagnosis of volume depletion in 2005 was replaced by subendocardial infarction in 2006 (Table 2). The prevalence of primary discharge diagnoses presented in Table 2 may be different from the comorbidity data presented in Table 1 as the latter may have been estimated using more than one ICD-9 code and may have been based on both primary and secondary discharge diagnoses.

Predictors of In-Hospital Mortality in 2005

Overall, 8% (151 / 1904) of NH residents in the 2005 cohort died during hospitalization. In contrast, 3% (6671 / 204231) of the patients 45 years and older not admitted from a NH died during hospital stay in the same year (*data not shown*). Bivariate and multivariable-adjusted predictors of in-hospital mortality in the 2005 cohort are displayed in Table 3. Compared with age <65 years, age 75–84 years (adjusted odds ratio {OR}, 2.80; 95% confidence interval {CI}, 1.36–5.75; $P=0.005$), and ≥ 85 years (AOR, 2.53; 95% CI, 1.21–5.30; $P=0.013$) were associated with increased odds of in-hospital mortality. Sex and race were not associated with in-hospital mortality.

Compared with the 6% in-hospital death rate observed among NH residents without acute respiratory failure, 35% of those with acute respiratory failure died during hospitalization (unadjusted OR, 8.38; 95% CI, 5.53–12.69; $P<0.0001$; Table 3). The association between acute respiratory failure and in-hospital mortality remained strong and significant despite adjustment for other potential confounders (adjusted OR, 5.67; 95% CI, 3.51–9.17; $P<0.0001$). Compared with the 6% in-hospital mortality among NH residents without septicemia, 25% of those with the condition died during hospitalization (unadjusted OR, 5.91; 95% CI, 4.12–8.48; $P<0.0001$; Table 3). This association between septicemia and in-hospital mortality remained strong and significant despite adjustment for other possible confounders (adjusted OR, 4.63; 95% CI, 3.08–6.96; $P<0.0001$). Other significant acute conditions that predicted in-hospital mortality included acute renal failure (adjusted OR, 2.11; 95% CI, 1.30–3.41; $P=0.002$) and pneumonia (adjusted OR, 1.74; 95% CI, 1.14–2.66; $P=0.010$). A hospital length of stay of six days or longer was associated with reduced in-hospital mortality (adjusted OR, 0.44; 95% CI, 0.35–0.65; $P<0.0001$). Associations between other covariates and in-hospital mortality are displayed in Table 3.

Predictors of In-Hospital Mortality in 2006

Overall, 10% (174 / 1752) of the NH residents in the 2006 cohort died during hospitalization. In contrast, 3% (6450 / 206325) of the patients 45 years and older not admitted from a NH died during hospitalization in the same year (*data not shown*). Except for pneumonia, all the four acute conditions that predicted in-hospital mortality in the 2005 cohort also predicted in-hospital mortality in the 2006 cohort (Table 4). Acute respiratory failure remained the strongest predictor of in-hospital mortality in hospitalized NH residents in 2006 (adjusted OR, 7.11; 95% CI, 4.46–11.33; $P<0.0001$), followed by septicemia (adjusted OR, 3.91; 95% CI, 2.64–5.80;

$P < 0.0001$). Although the association between pneumonia and in-hospital mortality lost statistical significance in 2006, it remained of borderline significance.

Discussion

The findings of the current study demonstrate that in 2005 and 2006, NH residents represent nearly 0.5% of all hospitalized patients in the United States and that nearly 10% of all hospitalized NH residents died during hospitalization. We also demonstrate that in addition to age ≥ 85 years, three acute conditions were strong predictors of in-hospital mortality for these patients and that no chronic medical conditions were associated with increased in-hospital deaths. These covariates also predicted in-hospital mortality in a national cohort of hospitalized NH residents in 2006 suggesting generalizability of these findings. Finally, we also demonstrated that in-hospital death was associated with shorter length of stays suggesting that deaths associated with these predictors occurred early in the hospital stay. These findings are important because those aged ≥ 85 years are the fastest growing segment of the United States population, and it is projected that the proportion of the population ≥ 85 years living in the NH's will proportionately increase in the coming decades. These findings are also important as they may help identify NH residents who might be at an increased risk of in-hospital death and thus potential candidates for palliative and supportive care services in the NH or hospital setting.

The proportion ($\sim 0.5\%$) of hospitalized patients, who were NH residents in our study, is similar to the proportion ($\sim 0.5\%$ or ~ 1.5 million) of the United States population that are NH residents. Although this might suggest a proportionate representation of the US population, considering the high prevalence of chronic disease and functional impairment among NH residents, the proportion of NH residents in our study seems low. While the reasons for this low prevalence of NH residents among hospitalized patients may be multi-factorial, one possibility is that hospitalization for NH residents involves a complex selection process with consideration, among other factors, of patient, family, and provider preferences. Therefore, hospitalized NH residents may represent a rather select subgroup of NH residents whose family or personal preference led to aggressive treatment measures and were expected to have a better prognosis. Yet, in our study, we observed that hospitalized NH residents had a very high risk for in-hospital mortality. This is likely due to the fact that NH residents who were transferred to hospitals for acute care were a high risk group by virtue of their acute illnesses.

While NH residents, on average, suffer from multiple chronic medical conditions, we observed that neither the presence of chronic conditions such as coronary artery disease, nor an acute exacerbation of a chronic condition such as heart failure was associated with increased in-hospital mortality. On the other hand, the occurrence of acute events such as acute respiratory failure, septicemia, and acute renal failure were strong and independent predictors of in-hospital mortality among hospitalized NH residents. While the presence of chronic conditions may not have directly increased the risk of in-hospital death, they may have increased the risk of acute conditions that may in turn increase the risk of in-hospital death. For example, chronic obstructive pulmonary disease (COPD) may increase the risk of acute respiratory failure. A retrospective analysis of our data indicates that of the 483 hospitalized NH resident with COPD, 47 (10%) had acute respiratory failure. It is possible that NH residents with COPD who developed acute respiratory failure were given a hospital discharge diagnosis of acute respiratory failure.

Similarly, chronic kidney disease may have increased the risk of acute renal failure. NH residents with COPD are also at increased risk of pneumonia and septicemia, which in turn may be associated with increased risk of in-hospital death. We note that while pneumonia was a significant predictor of in-hospital death in the 2005 cohort, it did not predict in-hospital death in the 2006 cohort suggesting possible weak association and lack of generalizability.

Similar weaker associations with in-hospital mortality were also observed for female gender and age 75-84 years. The increased in-hospital mortality of NH residents ≥ 85 years may in part be due to the increased burden of morbidity and functional decline in these patients. However, this association persisted despite adjustment for many of those confounders suggesting that age ≥ 85 years may be associated with intrinsic biological changes that may have impaired their ability to endure and survive acute events.

To the best of our knowledge this is the first report of predictors of in-hospital mortality in hospitalized NH residents in a national sample based on NHDS data. Although studies have suggested that acute respiratory failure, septicemia and acute renal failure are associated with poor outcomes in non-NH populations, very little is known about the effect of these conditions on outcomes in hospitalized NH residents.¹¹⁻¹⁵ However, findings from those studies suggest that multiple acute conditions often coexist. For example, a retrospective analysis of our data suggests that of the 423 (22% of 1904) hospitalized NH residents in 2005 that had one of the three predictor acute conditions, 77% had any one, 20% had any two and 3% had all the three conditions. We also observed that the in-hospital mortality rate increased proportionately with the increase in the number of the predictors: 15%, 40% and 100% for those with any one, any two or all three of the predictors, respectively.

These findings are important as they may help identify NH residents who might be at increased risk of in-hospital mortality. We observed that compared to hospitalized non-NH residents, hospitalized NH residents had a nearly three times higher in-hospital mortality. Findings from our study also suggest that chronic conditions, which are highly prevalent in NH residents and their acute exacerbations, were not associated with increased in-hospital mortality. Therefore, the presence of a specific chronic condition alone may not be helpful in identifying patients at risk of poor outcome during hospitalization. On the other hand, acute events that were strong predictors of increased in-hospital mortality may not have been detected in the NH. For example, a NH resident with COPD may be sent to the hospital for pneumonia but he/she may later develop septicemia, acute respiratory failure and/or acute renal failure during hospitalization. We also demonstrated that NH residents ≥ 85 years are at increased risk of in-hospital mortality. Because NH residents ≥ 85 years are a heterogeneous group of individuals, it is essential to individualize the treatment plan for NH residents, incorporating plans for palliative care for acute exacerbations of chronic medical conditions that may lead to acute conditions associated with high in-hospital mortality. The short length of hospital stay for NH residents who died in the hospital highlights the rapid progression of those conditions and suggests that these patients may benefit from palliative care interventions and supportive treatment in the NH. Therefore, elderly NH residents with chronic conditions with the potential to develop into acute predictors of in-hospital mortality should have advanced planning which needs to consider the option for palliative care in the NH setting.

Strengths of our study include a large national sample, a large number of covariates, and our use of a second national sample to test the generalizability of our findings. Several weaknesses of our study must be acknowledged. We had no data on patient or family preference, functional and cognitive status of the residents, or severity of various comorbidities. Also, the use of the ICD-9 codes may have underestimated the prevalence of some of the chronic conditions such as hypertension, dementia, and coronary artery disease. The ICD-9 code was not useful in identifying diabetes and CKD and we had no data on serum glucose or creatinine. Variations in the use of ICD-9 codes between the survey years may also explain the differences in the baseline prevalence of some of the comorbidities such as coronary artery disease and CKD.

In conclusion, in hospitalized NH residents, in-hospital mortality was high, occurring mostly within the first week of hospitalization, and was predicted by age ≥ 85 years, acute respiratory failure, septicemia and acute renal failure. While chronic morbidities were not associated with

in-hospital mortality, their presence may precipitate those acute events. Therefore, elderly NH residents with chronic morbidities should have advanced planning that offers the option for palliative care in the NH setting.

Box 1

ICD codes used to define chronic comorbidities and acute and acute-on-chronic conditions

Chronic comorbidities:

1. Coronary artery disease
412, 414.00, 414.01, 414.05, 414.8, 414.9, 414.10
2. Hypertension
401.0, 401.1, 401.9, 402.00, 402.10, 402.11, 402.90, 402.91, 403.01, 403.11, 403.90, 403.91, 404.03, 404.13, 404.91, 404.92, 404.93
3. Heart failure
428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.43, 428.9
4. Chronic obstructive pulmonary disease
491.20, 491.21, 491.22, 491.8, 492.0, 492.8, 493.20, 490, 493.22, 496, 494.0, 493.92, 493.90, 491.1, 491.9
5. Dementia
294.8, 331.82, 331.19, 290.42, 291.2, 294.10, 294.11, 20.0, 290.21, 290.20, 290.3, 290.40, 290.41
6. Depression
296.0, 296.2, 296.20, 296.23, 296.3, 296.30, 296.33, 296.34, 296.4, 296.40, 296.5, 296.50, 296.2, 296.3, 296.4, 296.5, 296.6 300.4, 311, V79.0

Acute and acute-on-chronic conditions

1. Acute respiratory failure
518.81
2. Acute myocardial infarction
410.02, 410.12, 410.41, 410.42, 410.70, 410.71, 410.72, 410.81, 410.91, 410.92, 429.7, 411.0
3. Acute renal failure
584.5, 584.8, 584.9
4. Stroke
433.10, 433.11, 433.30, 433.31, 433.81, 434.00, 434.11, 434.91, 435.1, 435.8, 435.9, V17.1, 997.02, V12.54
5. Pneumonia
481, 482.0, 482.1, 482.2, 482.40, 482.41, 482.49, 482.82, 482.83, 482.84, 482.9, 486, 487.0

6. Septicemia

038.0, 038.10, 038.11, 038.19, 038.3, 038.40, 038.42, 038.43, 038.44, 038.49,
038.8, 038.9

7. Delirium

293.0, 293.1, 293.81, 290.41, 290.11, 290.3, 292.81

8. Volume Depletion

276.5, 276.50, 276.51, 276.52

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Figure 1.
Flow chart for selection of study cohort

Table 1

Baseline characteristics by survey year

N (%), mean (±SD)	Survey year 2005 (N=1904)	Survey year 2006 (N=1752)	P value
Age (years), mean (±SD)	78.6 (± 11.4)	78.2 (± 11.7)	0.273
Age categories			
45 to 64 years	240 (12.6%)	251 (14.3%)	0.412
65 to 74 years	329 (17.3%)	312 (17.8%)	
75 to 84 years	675 (35.5%)	606 (34.6%)	
≥85 years	660 (34.7%)	583 (33.3%)	
Female	1190 (62.5%)	1088 (62.1%)	0.803
African American	290 (15.2%)	272 (15.5%)	0.805
Chronic comorbid conditions			
Hypertension	786 (41.3%)	720 (41.1%)	0.909
Chronic heart failure	584 (30.7%)	532 (30.4%)	0.840
Coronary artery disease	293 (15.4%)	189 (10.8%)	<0.0001
COPD	483 (25.4%)	464 (26.5%)	0.441
Dementia	385 (20.2%)	306 (17.5%)	.034
Depression	105 (5.5%)	83 (4.7%)	.288
Acute and sub-acute conditions			
Pneumonia	298 (15.7%)	260 (14.8%)	0.496
Acute myocardial infarction	70 (3.7%)	63 (3.6%)	0.897
Acute heart failure	584 (30.7%)	532 (30.4%)	0.840
Stroke	72 (3.8%)	59 (3.4%)	0.501
Septicemia	236 (12.4%)	223 (12.7%)	0.761
Delirium	13 (0.7%)	18 (1.0%)	0.256
Volume depletion	321 (16.9%)	307 (17.5%)	0.595
Acute renal failure	173 (9.1%)	198 (11.3%)	0.027
Acute respiratory failure	126 (6.6%)	114 (6.5%)	0.893
Hospitals by bed size			
6-199 beds	522 (27.4%)	506 (28.9%)	0.106
200-499 beds	1278 (67.1%)	1175 (67.1%)	
≥500 beds	104 (5.5%)	71 (4.1%)	
Hospitals by geographic region			
Northeast	817 (42.9%)	739 (42.2%)	0.941
Midwest	561 (29.5%)	530 (30.3%)	
South	324 (17.0%)	302 (17.2%)	
West	202 (10.6%)	181 (10.3%)	
Hospitals by ownership			
Proprietary	56 (2.9%)	57 (3.3%)	0.076

N (%), mean (±SD)	Survey year 2005 (N=1904)	Survey year 2006 (N=1752)	P value
Government	162 (8.5%)	186 (10.6%)	
Non-profit	1686 (88.6%)	1509 (86.1%)	
Insurance Status			
Medicare (primary source of payment)	1629 (85.6%)	1513 (86.4%)	0.486
Medicaid	390 (20.5%)	437 (24.9%)	0.001
Private	586 (30.8%)	524 (29.9%)	0.568
Emergency admission	1202 (63.1%)	1168 (66.7%)	0.025
Length of stay			
< 6 days	933 (49.0%)	857 (48.9%)	0.958
> 6 days	971 (51.0%)	895 (51.1%)	
Discharge in July or August	316 (16.6%)	310 (17.7%)	0.379

Table 2

Top 10 ICD-9 codes for primary discharge diagnoses by year

Survey Year 2005			Survey Year 2006			
	Codes	Description	N (%)	Codes	Description	N (%)
1	486	Pneumonia, organism unspecified	120 (6.3%)	486	Pneumonia, organism unspecified	108 (6.2%)
2	V57.89	Care involving use of rehabilitation procedures	96 (5.0%)	038.9	Unspecified septicemia	97 (5.5%)
3	428.0	Congestive heart failure, unspecified	93 (4.9%)	V57.89	Care involving use of rehabilitation procedures	80 (4.6%)
4	599.0	Urinary tract infection, site not specified	89 (4.7%)	599.0	Urinary tract infection, site not specified	77 (4.4%)
5	038.9	Unspecified septicemia	70 (3.7%)	428.0	Congestive heart failure, unspecified	67 (3.8%)
6	507.0	Pneumonitis due to inhalation of food or vomitus	65 (3.4%)	507.0	Pneumonitis due to inhalation of food or vomitus	67 (3.8%)
7	518.81	Acute respiratory failure	56 (2.9%)	584.9	Acute renal failure, unspecified	51 (2.9%)
8	276.5	Volume depletion	48 (2.5%)	518.81	Acute respiratory failure	47 (2.7%)
9	584.9	Acute renal failure, unspecified	45 (2.4%)	410.71	Subendocardial infarction	32 (1.8%)
10	491.21	Obstructive chronic bronchitis with (acute) exacerbation	32 (1.7%)	491.21	Obstructive chronic bronchitis with (acute) exacerbation	30 (1.7%)

Table 3

Predictors of in-hospital mortality among hospitalized nursing home residents in 2005

	Unadjusted odds ratio (95% confidence interval)	P value	Adjusted odds ratio (95% confidence interval)	P value
Age 65-74 years	0.63 (0.38 – 1.04)	0.072	1.44 (0.63 – 3.32)	0.392
Age 75-84 years	1.50 (1.07 – 2.10)	0.018	2.80 (1.36 – 5.75)	0.005
Age ≥85 years	1.09 (0.77 – 1.54)	0.636	2.53 (1.21 – 5.30)	0.013
Female	0.71 (0.51 – 1.00)	0.047	0.87 (0.60 – 1.26)	0.445
African American	1.11 (0.71 – 1.75)	0.637	1.10 (0.67 – 1.81)	0.700
Acute and sub-acute conditions				
Pneumonia	2.61 (1.80 – 3.78)	<0.0001	1.74 (1.14 – 2.66)	0.010
Septicemia	5.91 (4.12 – 8.48)	<0.0001	4.63 (3.08 – 6.96)	<0.0001
Acute renal failure	3.22 (2.11 – 4.92)	<0.0001	2.11 (1.30 – 3.41)	0.002
Acute respiratory failure	8.38 (5.53 – 12.69)	<0.0001	5.67 (3.51 – 9.17)	<0.0001
Length of stay ≥6 days	0.73 (0.52 – 1.02)	0.063	0.44 (0.30 – 0.65)	<0.0001

Table 4

Predictors of in-hospital mortality among hospitalized nursing home residents in 2006

	Unadjusted odds ratio (95% confidence interval)	P value	Adjusted odds ratio (95% confidence interval)	P value
Age 65-74 years	0.92 (0.60 – 1.39)	0.678	1.50 (0.75 – 3.00)	0.258
Age 75-84 years	0.97 (0.70 – 1.35)	0.842	1.68 (0.90 – 3.16)	0.105
Age ≥85 years	1.44 (1.04 – 1.98)	0.027	2.45 (1.31 – 4.59)	0.005
Female	0.64 (0.47 – 0.88)	0.005	0.69 (0.49 – 0.97)	0.032
African American	0.95 (0.61 – 1.48)	0.823	1.05 (0.65 – 1.70)	0.835
Acute and sub-acute conditions				
Pneumonia	1.99 (1.36 – 2.89)	<0.0001	1.51 (0.99 – 2.31)	0.056
Septicemia	4.57 (3.21 – 6.50)	<0.0001	3.91 (2.64 – 5.80)	<0.0001
Acute renal failure	3.76 (2.59 – 5.45)	<0.0001	2.75 (1.82 – 4.15)	<0.0001
Acute respiratory failure	8.35 (5.51 – 12.63)	<0.0001	7.11 (4.46 – 11.33)	<0.0001
Length of stay ≥6 days	0.95 (0.70 – 1.30)	0.003	0.56 (0.39 – 0.81)	0.002