ORIGINAL ARTICLE

Consequence of Dysphagia in the Hospitalized Patient

Impact on Prognosis and Hospital Resources

Kenneth W. Altman, MD, PhD; Gou-Pei Yu, MD, MPH; Steven D. Schaefer, MD

Objective: To determine if comorbid dysphagia in all hospitalized patients has the potential to prolong hospital stay and increase morbidity. Dysphagia is increasingly prevalent with age and comorbid medical conditions. Our research group has previously shown that dysphagia is a bad prognostic indicator in patients with stroke.

Design: Analysis of national database.

Main Outcome Measures: The National Hospital Discharge Survey (NHDS), 2005-2006, was evaluated for presence of dysphagia and the most common comorbid medical conditions. Patient demographics, associated disease, length of hospital stay, morbidity and mortality were also evaluated.

Results: There were over 77 million estimated hospital admissions in the period evaluated, of which 271 983 were associated with dysphagia. Dysphagia was most commonly associated with fluid or electrolyte disorder, esophageal disease, stroke, aspiration pneumonia, urinary tract infection, and congestive heart failure. The median number of hospitalization days for all patients with dysphagia was 4.04 compared with 2.40 days for those patients without dysphagia. Mortality increased substantially in patients with dysphagia associated with rehabilitation, intervertebral disk disorders, and heart diseases.

Conclusions: Dysphagia has a significant impact on hospital length of stay and is a bad prognostic indicator. Early recognition of dysphagia and intervention in the hospitalized patient is advised to reduce morbidity and length of hospital stay.

Arch Otolaryngol Head Neck Surg. 2010;136(8):784-789

THE CONSEQUENCES OF DYSphagia can be profound. Although it is appreciated that nutrition, hydration, quality of life issues, and social isolation may arise, aspiration (especially if not immediately recognized) may be the pivotal factor that precipitates a significant decline in a patient's outcome. Our research group[1] has previously shown that in patients hospitalized with stroke, only 14% of those without dysphagia required more than 7 days of hospitalization. When a patient with stroke also had dysphagia, their likelihood of hospitalization longer than 7 days was up to 73.9%.[1] These findings emphasize the importance of early diagnosis of dysphagia so that an appropriate plan of care can be instituted and so that the potential economic impact of a prolonged hospitalization might be mitigated.

The devastating effects of dysphagia on patients with stroke and the importance of early recognition are well known.[2,3] The consequences of dysphagia on hospitalized patients with heart disease[4] and pneumonia[5] and its association with laryngopharyngeal abnormalities (particularly with intubation) have also been recognized.[6] In this study, using data from the 2004 and 2005 National Hospital Discharge Survey (NHDS),[7] we sought to quantify the consequences of dysphagia in hospitalized patients admitted with other diagnoses. Our hypothesis was that dysphagia adversely affected outcomes as determined by length of hospitalization and increased risk of mortality during that hospitalization.

Author Affiliations:
Departments of Otolaryngology, The Mount Sinai School of Medicine (Dr Altman) and New York Eye and Ear Infirmary (Drs Yu and Schaefer), New York, New York.

METHODS

Data were obtained from the 2004 and 2005 National Hospital Discharge Survey (NHDS).[7] This sampling survey has been conducted continuously by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention, since 1985. The NHDS is a representative sample of patient discharge records from short-stay, nonfederal general and children's hospitals in the United States, exclusive of federal, military, and Veterans Administration hospitals. Only short-stay hospitals (those

with an average length of stay for all patients of <30 days) and those with a general specialty are included in the survey. Also, the hospitals must have 6 or more beds staffed for patient use. In 2005, the NHDS sample consisted of 473 eligible hospitals with a response rate of 93.9%. The sampling design assigns a discharge weight to each hospital record. The discharge weight is the number of hospitalizations that the hospital record represents, and use of these weights permits calculations of nationally representative hospitalization estimates. The unit of analysis was a hospitalization, not an individual patient.

The medical information recorded manually on the sample patient abstracts was coded to the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) by NCHS staff. A maximum of 7 diagnostic codes were assigned for each sample abstract. The NHDS usually presents diagnoses and procedures in the order in which they are listed on the abstract form or obtained from abstract services. However, the codes of some major diseases such as acute myocardial infarction or stroke diagnoses may be reordered to the first position if they are not listed as the first entry.

With the use of NHDS data, we first identified dysphagia (*ICD-9-CM* 787.2) occurring in any of the 7 listed diagnostic codes. We then used the same method to capture and define disorders and symptoms associated with dysphagia by all 7 listed diagnostic codes. We also distinguished major or accompanying disorders and symptoms by using first-listed diagnostic codes. As interpreted by the NHDS, the most important diagnoses are usually listed first. For instance, for a patient with stroke and hypertension at the same time, the stroke diagnostic code should be listed first and hypertension second or even lower on the list, depending on its importance relative to other disorders and symptoms. In our analysis, if the disorders and symptoms could not be identified as the 20 major disorders and symptoms by the first-listed diagnostic code but they could be identified by the second- to seventh-listed diagnostic codes, we defined them as *accompanying disorders and symptoms*; otherwise we defined them as *major disorders and symptoms*. For comparison purposes, we also looked at hospitalizations with these disorders and symptoms in patients who did not have dysphagia.

We used 2-year data from 2004 and 2005 to minimize the effect of year-to-year variability for estimates from the NHDS and to achieve sufficient numbers of hospitalizations for reliable estimates for certain comorbid conditions. Twenty major diseases among patients with dysphagia were identified by magnitude of occurrence, and calculated rates were obtained using the denominator of patients with dysphagia. In addition, we calculated mortality rates for diseases among patients with dysphagia such that the denominator was the number of patients with each disease and the numerator was the number of deaths due to the disease. We used SUDAAN software, version 9.0 (Research Triangle Institute, Research Triangle Park, NC), to calculate standard errors (SEs) and 95% confidence intervals (CIs) for disease rates and mortality rates to account for the stratified sampling techniques. With the same method, we calculated rates and 95% CIs for corresponding diseases among patients without dysphagia. To compare difference in the occurrence of diseases between patients with and without dysphagia, we used SUDAAN's logistic regression model to compute age- and sex-adjusted rates for patients with and without dysphagia and corresponding rate ratios (RRs) and 95% CIs.

RESULTS

There were 77 540 204 hospitalizations evaluated by the NHDS in the 2005-2006 period, of which 271 983 were associated with dysphagia (0.35% of all hospitalizations). **Table 1** lists the rate of dysphagia during this period as related to sex, age, and race. The most notable findings are that the numbers of hospitalizations increase with increasing age and that dysphagia is more prominently associated with older patients. For example, the age group 75 years or older had a 0.73% rate of dysphagia, more than twice the national average for all age groups.

Table 1. Rate of Dysphagia by Sex, Age, and Race Among Hospitalized Patients

Patient Characteristic	Hospitalizations, No.	Dysphagia Rate, No. (%)	SE
Total	77 540 204	271 983 (0.35)	0.01
Sex			
Male	31 976 946	128 783 (0.40)	0.02
Female	45 563 258	143 200 (0.31)	0.01
Age y			
<45	34 206 054	39 985 (0.12)	0.01
45-64	17 035 348	60 727 (0.36)	0.02
65-74	9 693 062	49 880 (0.51)	0.04
≥75	16 605 740	121 391 (0.73)	0.03
Race			
White	46 147 103	149 205 (0.32)	0.01
Black	9 213 321	29 229 (0.32)	0.03
Asian	1 302 353	4113 (0.32)	0.10
Other	2 012 462	4555 (0.23)	0.03
Unknown	18 864 965	84 881 (0.45)	0.02

Table 2 lists the 20 leading major diseases and symptoms associated with dysphagia, listed in decreasing order of total number of hospitalizations for that disorder. The rate is determined relative to the total number of hospitalizations for dysphagia (n=271 983). The most common dysphagia-related comorbid conditions were (1) fluid and electrolyte disorder, (2) disease of the esophagus, (3) ischemic stroke, and (4) aspiration pneumonia, accounting for about half of all dysphagia hospitalizations. Of those patients with dysphagia, 64.8% had all 7 diagnosis fields (and 88.9% had ≥5 diagnosis fields) listed on the NHDS at the time of discharge. In contrast, 38.6% of patients without dysphagia had all 7 diagnosis fields (and 57.5% had 5 or more diagnosis fields) listed on the NHDS at the time of discharge.

For comparison purposes, hospitalizations for these disorders are also listed under "not dysphagia." Compared with cases without dysphagia, cases with dysphagia were found to be significantly associated with aspiration pneumonia (RR, 9.1), ischemic stroke (RR, 5.1), and Parkinson disease (RR, 4.5). The RR was also significantly elevated in patients with hemorrhagic stroke, stomach disorders, care associated with rehabilitation, Alzheimer disease, and diseases of the esophagus. The age- and sex-adjusted RRs of these disorders were 2-fold or larger. Table 2 also lists the 7 major accompanying disorders and symptoms. A significantly increased association with dysphagia was found in hemiplegia and hemiparesis (RR, 17.2), dyspnea and respiratory abnormalities (RR, 3.2), and persistent mental disorders (RR, 2.7).

Table 3 lists the risk of mortality in major diseases associated with dysphagia. The number of cases of dysphagia associated with each disorder is listed along with the number of deaths. For patients undergoing rehabilitation, the adjusted RR for mortality in patients with dys-

Table 2. Major Diseases and Symptoms Associated With Dysphagia From the National Hospital Discharge Survey, 2005-2006[7]

Disease and/or Symptom (*ICD-9-CM* Code)	Dysphagia (n=271 983) Rank	Dysphagia (n=271 983) Rate, No. (%)	Dysphagia (n=271 983) SE	No Dysphagia (n=77 268 221) Rate, No. (%)	No Dysphagia (n=77 268 221) SE	Age- and Sex-Adjusted RR (95% CI)
Major Disorders and Symptoms[a]						
Pneumonia due to inhalation of food or vomitus (507.0)	4	32 643 (12.0)	1.0	739 661 (1.0)	0.0	9.1 (7.5-11.2)[b]
Ischemic stroke (433-434, 436, 437.0-437.2)	3	40 289 (14.8)	1.1	1 609 874 (2.1)	0.0	5.1 (4.2-6.1)[b]
Parkinson disease (332.0-332.1)	9	12 535 (4.6)	0.7	452 110 (0.6)	0.0	4.5 (3.2-6.2)[b]
Hemorrhagic stroke (430-432)	16	5925 (2.2)	0.6	300 740 (0.4)	0.0	4.0 (2.4-6.6)[b]
Disorders of function of stomach (536)	14	7327 (2.7)	0.6	499 944 (0.7)	0.0	4.0 (2.5-6.4)[b]
Care involving use of rehabilitation procedure (V5789)	11	11 658 (4.3)	0.5	817 568 (1.1)	0.0	2.7 (2.1-3.4)[b]
Alzheimer disease (331.0)	10	12 526 (4.6)	0.6	790 275 (1.0)	0.0	2.4 (1.8-3.2)[b]
Disease of esophagus (530)	2	40 973 (15.1)	1.1	4 902 438 (6.3)	0.1	2.1 (1.8-2.5)[b]
Urinary tract infection (599.0)	5	28 154 (10.4)	0.8	4 552 421 (5.9)	0.1	1.2 (1.0-1.4)[c]
Fluid and electrolyte disorder (276)	1	47 520 (17.5)	1.3	8 363 757 (10.8)	0.1	1.2 (1.0-1.5)[c]
Intervertebral disc disorders (722)	19	3853 (1.4)	0.3	881 552 (1.1)	0.0	1.2 (0.8-1.9)
Pneumonia (480-487)	7	22 102 (8.1)	0.8	4 630 658 (6.0)	0.1	1.0 (0.8-1.2)
Disease of lung (722)	13	8195 (3.0)	0.4	1 920 329 (2.5)	0.0	0.9 (0.7-1.2)
Acute and chronic respiratory failure (518)	17	7729 (2.8)	0.4	1 754 385 (2.3)	0.0	0.9 (0.7-1.2)[b]
Chronic bronchitis (491.0-491.9)	12	9772 (3.6)	0.5	2 327 774 (3.0)	0.0	0.8 (0.6-1.0)[c]
Congestive heart failure (428.0, 428.2-428.9)	6	27 437 (10.1)	0.9	7 878 929 (10.2)	0.1	0.5 (0.4-0.6)[b]
Cardiac dysrhythmias (427)	15	6852 (2.5)	0.4	2 642 268 (3.4)	0.0	0.5 (0.4-0.6)[b]
Septicemia (038)	18	4581 (1.7)	0.3	1 742 458 (2.3)	0.0	0.5 (0.3-0.7)[b]
Coronary atherosclerosis (414)	8	19 755 (7.3)	0.8	8 652 725 (11.2)	0.1	0.3 (0.3-0.4)[b]
Acute myocardial infarction (410)	20	3076 (1.1)	0.3	1 678 232 (2.2)	0.0	0.3 (0.2-0.5)[b]
Accompanying Disorders and Symptoms[d]						
Hemiplegia and hemiparesis (342)	NA	20 659 (7.6)	0.9	258 044 (0.3)	0.0	17.2 (13.0-22.8)[b]
Dyspnea and respiratory abnormalities (786.0)	NA	5376 (2.0)	0.7	452 263 (0.6)	0.0	3.2 (1.7-6.2)[b]
Persistent mental disorders (294)	NA	28 632 (10.5)	0.9	1 782 400 (2.3)	0.0	2.7 (2.2-3.3)[b]
Chronic airway obstruction (496)	NA	22 217 (8.2)	0.7	4 298 088 (5.6)	0.1	0.9 (0.7-1.1)[b]
Essential hypertension (401)	NA	82 312 (30.3)	1.5	17 974 857 (23.3)	0.1	0.8 (0.7-1.0)[b]
Diabetes mellitus (250)	NA	36 100 (13.3)	1.0	9 626 962 (12.5)	0.1	0.7 (0.6-0.9)[c]
Atrial fibrillation and flutter (427.3)	NA	24 531 (9.0)	0.9	5 900 352 (7.6)	0.1	0.6 (0.5-0.8)[b]

Abbreviations: CI, confidence interval; *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*; NA, not applicable; RR, rate ratio.

[a] Major disorders and symptoms were identified when the first-listed diagnostic code was used.

[b] $P < .001$.

[c] $P < .05$.

[d] Accompanying disorders and symptoms were not identified as major disorders and symptoms when the first-listed diagnostic code was used but when the second- and seventh-listed diagnostic codes were used.

phagia compared with patients without dysphagia was significantly elevated (RR, 13.7) ($P < .001$). The mortality risks for patients with dysphagia were also significantly higher in coronary atherosclerosis ($P < .01$) and nonsignificantly higher in intervertebral disc disorders ($P > .05$) and cardiac dysrhythmias ($P > .05$). The risks of dysphagia-associated mortality with other diseases and symptoms were not significantly increased (RR, approximately ≤ 1).

The median numbers of hospitalization days are listed in **Table 4** for major diseases associated with dysphagia and not associated with dysphagia. The median number of hospitalization days for patients without dysphagia was 2.4 compared with 4.04 days in patients with dysphagia. This difference represents a 40.6% increase in length of hospitalization when a patient admitted with any diagnosis also had dysphagia. The most notably increased length of stay was found in patients with hemorrhagic stroke (10.55 days in patients with dysphagia vs 4.74 days in patients without dysphagia). Length of stay was also increased by 30% or more for congestive heart failure, Parkinson disease, and ischemic stroke when dysphagia was present. The longest length of stay was found in rehabilitation (12.53 days in patients with dysphagia vs 9.40 days in patients without dysphagia).

COMMENT

We report herein a number of important findings relative to hospitalized patients with dysphagia: (1) age older than 75 years was associated with double the risk of dysphagia associated with hospitalization; (2) the presence of dysphagia was associated with a 40% increase in length of hospital stay in all age groups; and (3) patients undergoing rehabilitation had a greater than 13-fold increased risk of mortality during their hospitalization when they had dysphagia. While the NHDS (with its implicit limitations) does not demonstrate a cause-effect relationship between dysphagia and other variables, the association between the presence of dysphagia and mortality risk is not surprising in the rehabilitation population. Dysphagia is present with a greater number of comorbidities, which may in consort lead to increased mortality risk. Similarly, these debilitated patients have ongo-

Table 3. Risk of Mortality of Major Dysphagia-Related Diseases and Symptoms From the National Hospital Discharge Survey, 2005-2006[7]

Disease and/or Symptom (*ICD-9-CM* Code)	Dysphagia (n=271 983)			No Dysphagia (n=77 268 221)			Age- and Sex-Adjusted RR (95% CI)
	Cases, No.	Deaths, No. (%)	SE	Cases, No.	Deaths, No. (%)	SE	
Major Disorders and Symptoms[a]							
Use of rehabilitation procedure (V5789)	11 658	464 (4.0)	2.6	817 568	2361 (0.3)	0.1	13.7 (3.5-54.5)[b]
Intervertebral disc disorders (722)	3853	43 (1.1)	1.1	881 552	2139 (0.2)	0.1	3.7 (0.3-41.4)
Coronary atherosclerosis (414)	19 755	1017 (5.2)	1.9	8 652 725	145 416 (1.7)	0.1	2.6 (1.2-5.6)[c]
Cardiac dysrhythmias (427)	6852	799 (11.7)	4.4	2 642 268	179 280 (6.8)	0.3	1.8 (0.8-4.2)
Pneumonia (480-487)	22 102	2046 (9.3)	3.8	4 630 658	287 723 (6.2)	0.2	1.3 (0.5-3.2)
Ischemic stroke (433-434, 436, 437.0-437.2)	40 289	2400 (6.0)	2.1	1 609 874	84 573 (5.3)	0.3	1.1 (0.5-2.3)
Alzheimer disease (331.0)	12 526	555 (4.4)	2.7	790 275	31 399 (4.0)	0.4	1.1 (0.3-4.0)
Parkinson disease (332.0-332.1)	12 535	320 (2.6)	1.3	452 110	10 715 (2.4)	0.4	1.1 (0.4-3.2)
Congestive heart failure (428.0, 428.2-428.9)	27 437	1667 (6.1)	1.7	7878 929	438 125 (5.6)	0.2	1.0 (0.5-1.8)
Fluid and electrolyte disorder (276)	47 520	2545 (5.4)	1.9	8 363 757	418 914 (5.0)	0.1	0.9 (0.4-1.9)
Disease of lung (722)	8195	1781 (21.7)	7.6	1 920 329	442 580 (23.1)	0.6	0.9 (0.4-2.2)
Acute and chronic respiratory failure (518)	7729	1781 (23.0)	8.0	1 754 385	419 971 (23.9)	0.6	0.9 (0.4-2.3)[c]
Disorder of function of stomach (536)	7327	112 (1.5)	1.0	499 944	9012 (1.8)	0.4	0.6 (0.1-2.4)
Urinary tract infection (518)	28 154	775 (2.8)	0.8	4 552 421	164 608 (3.6)	0.2	0.7 (0.4-1.2)
Disease of esophagus (530)	40 973	229 (0.6)	0.3	4 902 438	43 185 (0.9)	0.1	0.6 (0.2-1.6)
Septicemia (038)	4581	510 (11.1)	4.6	1 742 459	331 599 (19.0)	0.5	0.5 (0.2-1.3)[d]
Pneumonia due to inhalation of food or vomitus (507.0)	32 643	2804 (8.6)	2.2	739 661	13 2521 (17.9)	0.9	0.4 (0.2-0.7)[b]
Chronic bronchitis (491.0-491.9)	9772	159 (1.6)	1.2	2 327 774	84 677 (3.6)	0.2	0.4 (0.1-1.9)
Acute myocardial infarction (410)	3076	134 (4.4)	3.1	1 678 232	152 692 (9.1)	0.4	0.3 (0.1-1.4)
Hemorrhagic stroke (430-432)	5925	173 (2.9)	1.6	300 740	67 070 (22.3)	1.4	0.1 (0.0-0.3)[b]
Accompanying Disorders and Symptoms[e]							
Diabetes mellitus (250)	36 100	690 (1.9)	0.7	9 626 962	151 622 (1.6)	0.1	1.0 (0.5-2.1)[d]
Hemiplegia and hemiparesis (342)	20 659	896 (4.3)	3.0	258 044	13 699 (5.3)	0.9	0.7 (0.2-2.9)
Dyspnea and respiratory abnormalities (786.0)	5376	43 (0.8)	0.8	452 263	10 339 (2.3)	0.5	0.3 (0.0-2.6)
Chronic airway obstruction (496)	22 217	988 (4.5)	1.7	4 298 088	195 232 (4.5)	0.2	0.9 (0.4-2.0)[d]
Atrial fibrillation and flutter (427.3)	24531	1407 (5.7)	1.7	5 900 352	296 124 (5.0)	0.2	1.0 (0.6-1.9)[c]
Essential hypertension (401)	82 312	1114 (1.4)	0.4	17 974 857	201 204 (1.1)	0.1	1.0 (0.6-1.7)[c]
Persistent mental disorders (294)	28 632	793 (2.8)	1.1	1 782 400	61 308 (3.4)	0.3	0.8 (0.3-1.8)[d]

Abbreviations: CI, confidence interval; *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*; RR, rate ratio.

[a] Major disorders and symptoms were identified when the first-listed diagnostic code was used.

[b] $P < .001$.

[c] $P < .01$.

[d] $P < .05$.

[e] Accompanying disorders and symptoms were not identified as major disorders and symptoms when the first-listed diagnostic code was used but when the second- and seventh-listed diagnostic codes were used.

ing needs for nutrition and hydration, so the presence of dysphagia has the potential to exacerbate risk of aspiration and its subsequent complications.

Importantly, the association between dysphagia and mortality or increased length of stay may represent dysphagia acting as a surrogate variable identifying disorder severity. In other words, dysphagia may be present as a consequence of other debilitating diseases that ultimately lead to these morbidities. This idea is supported by the finding that patients with dysphagia had more diagnoses overall at the time of discharge than patients without dysphagia (64.8% vs 38.6% had all 7 NHDS diagnosis fields listed). Unfortunately, the NHDS does not specify admitting diagnoses or time of acquiring dysphagia during the hospitalization. A follow-up study of this cohort may shed vital insight into pivotal moments during the hospitalizations when dysphagia could have been identified and acted on to improve patient outcomes.

While dysphagia occurs in only a small portion of hospitalized patients, the impact on hospital resources is substantial. The presence of aspiration often leads to the need for antibiotic use and endotracheal intubation, with their potential risks. Furthermore, hospital discharge planning is delayed secondary to enteral feeding plans that might include placement of nasogastric or percutaneous gastrostomy tubes. The increased association of dysphagia with mortality is also linked to costs associated with end-of-life care.

Specific costs associated with dysphagia in hospitalized patients are difficult to obtain because aggregate hospitalization figures do not reflect variable costs per patient associated with dysphagia. However, Raut et al[8] used the published literature to determine the economic impact of a half-day reduction in length of hospital stay among patients with community-acquired pneumonia (CAP) in the United States. The total cost per day was calculated as daily fixed cost (room and board) + variable costs (additional diagnostic and therapeutic services associated with CAP). Daily fixed cost was estimated to be 59% of the total daily cost. The daily fixed cost (room and board) for CAP hospitalization was estimated to be $1448 in 2007, with a total daily cost of $2454.

Table 4. Days of Hospitalization With Major Diseases and Symptoms Associated With Dysphagia, National Hospital Discharge Survey, 2005-2006[7]

Disease and/or Symptom (*ICD-9-CM* Code)	Hospitalization Days, Median No. (95% CI)		Difference, d (%)
	Dysphagia	No Dysphagia	
Total	4.04 (4.0-5.0)	2.40 (3.0-3.0)	1.64 (40.6)
Major Disorders and Symptoms[a]			
Hemorrhagic stroke (430-432)	10.55 (4.9-13.4)	4.74 (4.8-5.9)	5.81 (55.1)
Congestive heart failure (428.0, 428.2-428.9)	3.96 (4.0-5.1)	2.26 (2.9-2.9)	1.70 (42.9)
Parkinson disease (332.0-332.1)	5.70 (3.9-6.9)	3.49 (3.9-4.0)	2.21 (38.8)
Ischemic stroke (433-434, 436, 437.0-437.2)	5.07 (4.7-5.9)	3.26 (3.9-4.0)	1.81 (35.7)
Cardiac dysrhythmias (427)	3.91 (2.7-6.2)	2.76 (3.0-3.0)	1.15 (29.4)
Intervertebral disc disorders (722)	2.74 (0.0-4.9)	1.94 (NR)	0.80 (29.2)
Use of rehabilitation procedure (V5789)	12.53 (11.3-16.0)	9.40 (9.6-9.9)	3.13 (25.0)
Fluid and electrolyte disorder (276)	4.85 (5.0-6.1)	3.70 (3.9-4.0)	1.15 (23.7)
Pneumonia (480-487)	5.33 (4.9-6.8)	4.18 (4.6-4.7)	1.15 (21.6)
Coronary atherosclerosis (414)	3.14 (2.6-3.9)	2.54 (2.9-2.9)	0.60 (19.1)
Urinary tract infection (518)	5.27 (5.0-6.0)	4.36 (4.8-4.8)	0.91 (17.3)
Alzheimer disease (331.0)	4.35 (3.0-6.0)	3.72 (3.9-4.0)	0.63 (14.5)
Disease of esophagus (530)	2.93 (2.4-3.5)	2.51 (2.9-2.9)	0.42 (14.3)
Acute myocardial infarction (410)	4.01 (3.3-6.3)	3.54 (3.9-3.9)	0.47 (11.7)
Chronic bronchitis (491.0-491.9)	4.27 (3.7-4.9)	3.85 (4.0-4.0)	0.42 (9.8)
Disorder of function of stomach (536)	3.34 (1.9-4.3)	3.07 (3.0-4.0)	0.27 (8.1)
Acute and chronic respiratory failure (518)	6.98 (6.0-9.6)	6.85 (7.0-7.8)	0.13 (1.9)
Disease of lung (722)	6.89 (6.0-9.5)	6.90 (6.9-7.7)	–0.01 (–0.2)
Pneumonia due to inhalation of food or vomitus (507.0)	5.17 (4.9-6.8)	6.76 (6.7-8.0)	–1.59 (–30.8)
Septicemia (038)	4.87 (4.2-7.4)	6.70 (6.7-7.0)	1.83 (37.6)
Accompanying Disorders and Symptoms[b]			
Diabetes mellitus (250)	3.86 (3.4-4.7)	2.85 (3.0-3.0)	1.01 (26.2)
Hemiplegia and hemiparesis (342)	5.35 (5.0-6.8)	4.68 (4.9-5.0)	0.67 (12.5)
Dyspnea and respiratory abnormalities (786.0)	8.23 (3.1-13.2)	1.99 (NR)	6.24 (75.8)
Chronic airway obstruction (496)	3.89 (3.2-5.0)	3.6 (3.9-3.9)	0.27 (6.9)
Atrial fibrillation and flutter (427.3)	4.65 (4.0-5.5)	3.8 (4.0-4.0)	0.87 (18.7)
Essential hypertension (401)	3.89 (3.9-5.0)	2.6 (3.0-3.0)	1.28 (32.9)
Persistent mental disorders (294)	4.06 (3.6-4.7)	3.7 (3.9-4.0)	0.33 (8.1)

Abbreviations: CI, confidence interval; *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*; NR, not reported.
[a] Major disorders and symptoms were identified when the first-listed diagnostic code was used.
[b] Accompanying disorders and symptoms were not identified as major disorders and symptoms when the first-listed diagnostic code was used but when the second- and seventh-listed diagnostic codes were used.

Cautiously applying these measurement techniques and figures to hospitalization associated with dysphagia, we found an average of 135 992 hospitalizations with dysphagia per year, extending the average length of hospital stay 1.64 days. This diagnosis, therefore, results in an additional 223 027 hospitalization days per year. If one were to assume a comparable total daily cost of hospitalization associated with CAP and dysphagia, then the economic impact of dysphagia during hospitalization would be $547 307 964. However, we estimate that the variable costs associated with dysphagia in hospitalized patients are considerably higher than those associated with CAP. This is because the consequences of dysphagia (including possible mortality) can be expected to generate additional diagnostic studies, possible orotracheal intubation, and nasal or percutaneous gastrostomy tube placement.

We expect that the estimate of 0.35% of all hospitalized patients to have dysphagia is a gross underestimate. Many patients have baseline dysphagia that might not be severe enough to be recognized by a clinician or might be considered not immediately relevant to the purpose for hospitalization. Cichero et al[9] introduced formal nurse screening for dysphagia in an acute hospital setting in Australia and found that 109 of 442 patients were at risk of dysphagia. These patients had undergone formal speech therapy evaluation and 27% of them required modified diet or *non per os* (NPO) status. There are a number of possible reasons for our unexpectedly low finding: (1) the admitting physician failed to document all know diagnoses; (2) the dysphagia was not recognized during hospitalization; (3) more severe diseases were prioritized during medical chart extrapolation; and (4) the NHDS form was improperly coded at the time of discharge. We expect that these sources of error contribute to the very low estimate of the economic impact of dysphagia during hospitalization.

The NHDS data are important because of the large size of the survey and its comprehensive representation of the entire US population. The data allow us to specifically observe many dysphagia-related diseases and outcomes in hospitalization and help us to understand the status of dysphagia without the bias of single-hospital data. The NHDS data are particularly important for studying the incidence and pattern of serious diseases and the risk of mortality associated with these conditions. The NHDS data do not demonstrate a cause-effect relationship but rather show statistically significant associations of variables.

Despite quality controls, NHDS data are also subject to nonsampling or measurement errors, which include errors due to hospital nonresponse, missing abstracts, incomplete or inaccurately recorded information on abstract forms, and processing errors. We speculate that the rate of dysphagia in our study is likely an underestimate. This is because dysphagia is not a defined disease in most cases but rather a temporary result of an acute disease. As such, it might not be recorded by clinicians on the NHDS reporting form because it is a symptom rather than a major disease. Dysphagia and its potential relevance are also commonly overlooked.

We recommend early identification of dysphagia in hospitalized patients, particularly in those with high-risk comorbid conditions such as older age, stroke, dehydration, malnutrition, neurodegenerative disease, pneumonia, cardiac disease, and the need for rehabilitation.[9,10] The plan of care in these patients should include proper assessment, early intervention using appropriate therapy and aspiration precautions, and consideration of enteral feeding or supplementation options in the high-risk population. Further clinical research to address clinical pathways and outcomes in these populations could help to mitigate both the clinical and economic ill effects of this potentially devastating condition.

Submitted for Publication: September 8, 2009; final revision received April 8, 2010; accepted April 20, 2010.
Correspondence: Kenneth W. Altman, MD, PhD, Department of Otolaryngology, Mount Sinai School of Medicine, One Gustave L. Levy Place, Box 1189, New York, NY 10029 (Kenneth.altman@mountsinai.org).
Author Contributions: All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Altman, Yu, and Schaefer. *Acquisition of data:* Yu. *Analysis and interpretation of data:* Altman and Yu. *Drafting of the manuscript:* Altman. *Critical revision of the manuscript for important intellectual content:* Altman, Yu, and Schaefer. *Statistical analysis:* Yu. *Obtained funding:* Schaefer. *Administrative, technical, and material support:* Altman and Schaefer. *Study supervision:* Altman and Schaefer.
Financial Disclosure: None reported.
Previous Presentation: This article was presented at the Annual Meeting of the American Broncho-Esophagological Society; May 28-31, 2009; Phoenix, Arizona.

REFERENCES

1. Altman KW, Schaefer SD, Yu GP, et al; Neurolaryngology Subcommittee of the American Academy of Otolaryngology–Head and Neck Surgery. The voice and laryngeal dysfunction in stroke: a report from the Neurolaryngology Subcommittee of the American Academy of Otolaryngology–Head and Neck Surgery. *Otolaryngol Head Neck Surg.* 2007;136(6):873-881.
2. Steinhagen V, Grossmann A, Benecke R, Walter U. Swallowing disturbance pattern relates to brain lesion location in acute stroke patients. *Stroke.* 2009;40(5):1903-1906.
3. Heckert KD, Komaroff E, Adler U, Barrett AM. Postacute reevaluation may prevent dysphagia-associated morbidity. *Stroke.* 2009;40(4):1381-1385.
4. Barker J, Martino R, Reichardt B, Hickey EJ, Ralph-Edwards A. Incidence and impact of dysphagia in patients receiving prolonged endotracheal intubation after cardiac surgery. *Can J Surg.* 2009;52(2):119-124.
5. Kaysar M, Augustine T, Jim L, Benjamin C. Predictors of length of stay between the young and aged in hospitalized community-acquired pneumonia patients. *Geriatr Gerontol Int.* 2008;8(4):227-233.
6. Postma GN, McGuirt WF Sr, Butler SG, Rees CJ, Crandall HL, Tansavatdi K. Laryngopharyngeal abnormalities in hospitalized patients with dysphagia. *Laryngoscope.* 2007;117(10):1720-1722.
7. DeFrances CJ, Cullen KA, Kozak LJ. National Hospital Discharge Survey: 2005 annual summary with detailed diagnosis and procedure data. *Vital Health Stat 13.* 2007;(165):1-209.
8. Raut M, Schein J, Mody S, Grant R, Benson C, Olson W. Estimating the economic impact of a half-day reduction in length of hospital stay among patients with community-acquired pneumonia in the US. *Curr Med Res Opin.* 2009;25(9):2151-2157.
9. Cichero JA, Heaton S, Bassett L. Triaging dysphagia: nurse screening for dysphagia in an acute hospital. *J Clin Nurs.* 2009;18(11):1649-1659.
10. Hinchey JA, Shephard T, Furie K, Smith D, Wang D, Tonn S; Stroke Practice Improvement Network Investigators. Formal dysphagia screening protocols prevent pneumonia. *Stroke.* 2005;36(9):1972-1976.