Journal of Medical and Health Studies
ISSN: 2710-1452
DOI: 10.32996/jmhs
Journal Homepage: www.al-kindipublisher.com/index.php/jmhs

JMHS
AL-KINDI CENTER FOR RESEARCH AND DEVELOPMENT

| RESEARCH ARTICLE

Speech Language Pathology Consultations and Medical Outcomes for Patients with Aspiration Pneumonia

Christopher Bolinger[1] ✉ and James Dembowski[2]
[1]Texas Woman's University, Denton, TX
[2]Texas Tech University Health Sciences Center, Lubbock, TX (retired)
Corresponding Author: Christopher Bolinger, **E-mail**: cbolinger@twu.edu

| ABSTRACT
A retrospective study of 811 hospital records examined the relationship of SLP consultations for dysphagia to medical outcomes in aspiration pneumonia patients in an acute care setting. Speech-language pathologists (SLPs) were consulted on two-thirds of the total aspiration pneumonia patients. Results showed significant differences between patients who received SLP consultations and those who did not in length of stay, mortality, and morbidity. Speech-language pathology was consulted more as pneumonia severity increased. This likely accounted for the relationship between the length of stay and SLP consultations. When SLPs were consulted, more patients were discharged for further rehabilitation. When SLPs were not consulted, more patients expired. More males and geriatric patients were seen than females and non-geriatric adults, respectively. Results may be used to address local hospital policies and protocols and thus increase the quality of care by improving morbidity and mortality outcomes of aspiration pneumonia patients.

| KEYWORDS

Swallow, dysphagia, pneumonia, speech-language pathology

| ARTICLE INFORMATION

ACCEPTED: 19 August 2022 **PUBLISHED:** 21 August 2022 **DOI:** 10.32996/jmhs.2022.3.3.8

1. Introduction

Dysphagia is defined as "difficulty swallowing." The diagnosis of dysphagia, according to the International Classification of Disease 9th revision (ICD-9), refers to a broad classification of swallowing difficulties (Medicode, 1996). The diagnosis could refer to a psychological, physiological, or anatomical issue preventing or reducing oral intake of food or liquid. Health care professionals other than speech-language pathologists (SLPs), look for overt signs and symptoms of dysphagia such as coughing, choking, and throat clearing when persons are eating or drinking. Speech-language pathologists are specially trained to note more subtle signs/symptoms (e.g., changes in voice or respiration), and to perform structured diagnostic swallowing evaluations (ASHA, 2002). Speech pathology consultations to evaluate swallowing are common in acute care hospital settings, particularly in cases of aspiration pneumonia. Pneumonia is a bacterial, viral, or fungal infection of the lungs, arising from several sources. The present report focuses specifically on aspiration pneumonia, that is, on pneumonia directly related to dysphagia. Complications from aspiration pneumonia include septic shock, lung abscess, bacteremia, and respiratory failure (US National Library of Medicine, 2015). Untreated aspiration pneumonia may lead to long-term lung damage; therefore, SLP evaluation of dysphagia potentially impacts patient outcomes in cases where dysphagia leads to aspiration pneumonia.

The present study sought to clarify and extend the findings of a previous study by Bolinger and Dembowski (in review). That study examined data related to SLP consultations for all pneumonia patients admitted to an acute care hospital over the course of a single year. That study included records of 1,489 individuals diagnosed with all major classifications of pneumonia: non-organism specific, community-acquired, healthcare-acquired, and aspiration pneumonia.

Results from the preliminary study indicated the following:

- Speech-language pathologists only evaluated 31.4% of all pneumonia patients.
- Speech-language pathologists evaluated 60.4% of aspiration pneumonia patients, a greater proportion than for any other pneumonia category.
- Length of hospital stay for patients evaluated by speech-language pathologists was significantly longer than for patients who did not receive SLP evaluations.
- There was a significant difference in morbidity between patients evaluated by speech-language pathologists and those without evaluation, where morbidity was defined in terms of discharge disposition. Specifically, the largest percentage of patients receiving a speech-language pathology consultation was discharged to skilled nursing facilities or other rehabilitation units for additional post-acute rehabilitation.
- There was no significant difference in mortality between patients evaluated by speech-language pathologists and patients without evaluation.
- Age and gender were significantly related to SLP evaluations. Specifically, geriatric patients (60 years or older) were more likely to receive an SLP swallowing evaluation than non-geriatric adults, and males were more likely to receive an evaluation than females.

The goals of the present study were adjusted based on the previous findings. Specifically, the research targeted aspiration pneumonia instead of all pneumonia categories and examined patient data over a longer period of time. Because aspiration pneumonia was the primary category for which patients received SLP consultations, it provided the major source of data for data analysis focused on the potential impact of those consultations. The time frame represented the maximum time for which records could be examined using the ICD-9 coding system. The university medical center from which records were drawn implemented an electronic medical record system in 2011. The records requested were from 2011 until the initiation of the study, a three-year period from 2011 to 2014. Records beyond that time were not used due to the implementation of ICD-10 diagnostic codes. Records in the present study used the ICD-9 code for aspiration pneumonia (ICD-9 Code 507.0). The present study also sought to better account for illness severity than did the preliminary study. The examiners were challenged by the initial finding that hospital length of stay (LOS) was robustly associated with SLP consultations. We hypothesized that SLPs were more likely to be consulted for sicker patients and therefore, pneumonia severity was one likely variable that could explain that pattern. To this end, the CURB-65 score (Lim et. al, 2003) was derived from patient records as a measure of pneumonia severity and used as an independent variable in data analysis.

The long-range goal of this project was to identify factors which may improve the quality of health care for individuals diagnosed with aspiration pneumonia and decrease the overall cost of health care. The specific objective of this research project was to determine if medical referrals of patients with aspiration pneumonia for swallowing assessment and intervention to acute care hospital speech-language pathologists improve patient outcomes. Research questions were:

1. Is the length of stay greater when an SLP is not consulted?
2. How is the length of stay related to pneumonia severity, as indicated by the CURB-65 score, and to the combined variables of pneumonia severity and SLP consultations for dysphagia?
3. Is there a difference in mortality when speech-language pathology is not consulted?
4. Is there a difference in morbidity when speech-language pathology is not consulted?
5. How is morbidity related to pneumonia severity, as indicated by the CURB-65 score, and to the combined variables of pneumonia severity and SLP consultations for dysphagia?
6. Is the proportion of speech-language pathology consultations greater in the geriatric population?
7. Is the proportion of speech-language pathology consultations greater in the male or female population?
8. Does a higher CURB-65 score relate to whether speech-language pathology is consulted?
9. Is there a greater frequency of 30-day hospital readmissions for patients with aspiration pneumonia who do not receive a speech-language pathology consultation?

2. Methods

2.1 Research Design

This was a retrospective exploratory and descriptive investigation of a sample of persons admitted to a university-affiliated acute care hospital with a diagnosis of aspiration pneumonia. It investigated differences in outcomes associated with consultations or lack of consultations to speech-language pathology. Independent variables for this study were speech-language pathology consultation, and aspiration pneumonia severity. Dependent variables were the length of stay, mortality, and morbidity (defined as categories of discharge disposition). Age and gender were also examined for systematic patterns with regard to speech-language pathology consultations.

Speech-language pathology consultation was a categorical variable: consultation placed or not. *Length of stay (LOS)* was a continuous variable indicated by the total number of days the patient was hospitalized. *Mortality* was a categorical variable: alive or expired. *Morbidity* was a categorical variable; categories were: returned to the previous condition, referred to skilled-nursing facility (SNF)/rehabilitation facility, home health, death/hospice, and long-term acute-care (LTAC). *Age* was operationalized as adults 18 years of age to 64 years of age, or geriatrics 65 years of age and older. Categories for age were determined based upon the CURB-65 age categories and the qualifications set forth by Medicare. *Gender* was a categorical variable: male or female. *CURB-65* scores were ordinal along a 6-point scale, and ranged from "0" for no pneumonia to "5" for most severe pneumonia. Each letter of the name represents a component in the scale. Each item listed, if abnormal, received a point. The letter "C" represents confusion. Confusion was determined by the Glasgow Coma Scale. Any value less than 15 received a point. The letter "U" represents urea, a lab value noted in the medical record. A value greater than 19 mg/dL received a point. The "R" represents respiratory rate. A respiratory rate greater than 30 breaths per minute is considered abnormal and received a point. The "B" represents blood pressure. A systolic or diastolic blood pressure lower than normal (< 90 mmHg or ≤ 60 mmHg respectively) received an additional point. The "65" represents age. If the patient was 65 or older, the patient received an additional point.

2.2 Data Collection

Following IRB approval, charts for review were identified by requesting a report from the hospital Information Technology/Medical Records department based on these criteria:

1. Admitted between January 1, 2011, and November 1, 2014
2. Males and females aged 18-99 years
3. Diagnosed with aspiration pneumonia (ICD 9 – 507.x)

2.3 Participants

The study included 811 individuals diagnosed with aspiration pneumonia. Participants ranged in age from 18 to 98 years. The mean age of participants in the study was 61.96 years (SD=19.26 years). The sample included 502 males and 309 females. Race, education and socioeconomic status could not be reliably determined from the medical records, and so were not considered variables for this study.

2.4 Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS®) Version 24 (2016). Differences among categorical data sets were examined with Pearson's chi-squared analysis, using a two-tailed definition. Correlations were examined with Spearman's rank order correlation, or with the point-biserial correlation (for the association between a continuous and a dichotomous variable). Selected differences were examined with a t-test, and multiple regression was used to explore the variability in length of stay. The length of stay variable, like many duration measures, showed a long positive tail in the distribution. Therefore, a log transformation was used to normalize the distribution and facilitate appropriate statistical analysis.

3. Results

One independent variable of this study was SLP consultation for dysphagia. Of the total 811 patients with aspiration pneumonia, 478 received SLP consultations. That is, 58.9% of aspiration pneumonia cases received SLP swallowing consultations, though, by definition, all cases were likely related to swallowing problems, and thus all cases were potential candidates for SLP swallowing evaluations. The second independent variable in the study was the severity of pneumonia as defined by the CURB-65 score. Most patients were admitted to the hospital with a pneumonia severity rating of "4" (35.02%), followed by pneumonia severity of "3" and "5" (23.92% each), pneumonia severity of "2" (12.08%), pneumonia severity of "1" (4.44%), and pneumonia severity of "0" (0.62%).

Data were extracted interactively from the medical records. Reliability was assessed on the extraction of the following components from the patients' medical records: age, length of stay, morbidity, mortality, presence/absence of SLP consultation, presence/absence of confusion, urea values, respiration rate, and blood pressure. Intra-rater reliability was determined by the first author randomly selecting 10% of the patient records, re-analyzing the records, and then comparing results to the initially recorded values. Intra-rater reliability was 95.6%. Inter-rater reliability was determined by the second author randomly selecting 10% of the patient records, re-analyzing the records, and then comparing the results to the initial values. Inter-rater reliability was 96.5%.

Question 1: Is length of stay (LOS) greater when speech-language pathology is not consulted?

Mean length of stay for all patients with aspiration pneumonia was 10.83 days (SD = 10.091). The average length of stay for those who did not receive SLP swallowing consultations was 7.16 days (SD=6.415). The average length of stay for those who did receive SLP consultations was 13.39 days (SD=11.328). Thus, the length of stay for those who received swallowing consultations was near

double the length of stay of those who did not. The standard deviation for the consulted group was also substantially larger than the no-consultation group. A point biserial test of association between LOS and SLP consultations produced a positive correlation of rpb = 0.371, p=.000. This indicates a direct association between SLP consultations and length of stay. Specifically, SLP consultations were significantly associated with longer length of stay. A t-test confirmed a significant difference between transformed values for consultation and no-consultation groups; t(809)=-11.362, p = .000.

Question 2: How is length of stay related to pneumonia severity as indicated by the CURB-65 score, and to the combined variables of pneumonia severity and SLP consultations for dysphagia?

Table 1 shows the length of stay mean and standard deviation for each pneumonia severity category. A Spearman rank-order test of association indicated a significant positive relationship between LOS and pneumonia severity as measured by the CURB-65 score (rs=.363, p=.000). The more severe a patient's pneumonia at admission, the longer the length of stay.

Table 1: *Untransformed Mean Length of Stay*

	Aspiration Pneumonia	
	Mean Length of Stay	Standard Deviation
Combined Cases	10.83	10.091
Without SLP Consultation	7.16	6.415
With SLP Consultation	13.39	11.328

Multiple regression was used to examine the relationship between LOS, pneumonia severity, and presence/absence of SLP consultation. Length of stay was the dependent variable; pneumonia severity (CURB-65 score) and SLP consultation were predictor variables. Results showed that 19.5% of the variability in LOS was explained by the combined effects of SLP consultations and severity of pneumonia (R2 =.195, F(2,808)=99.187, p=.000). Pneumonia severity alone accounted for 6% of variability when SLP consultations were not included in the model. SLP consultations alone accounted for 10% of variability when pneumonia severity was not included in the model. Also, pneumonia severity alone significantly predicted increased length of stay (β=1.090, p<.01), as did SLP consultation (β=1.294, p<.01). Using the beta coefficients as predictors of change in the dependent LOS values, for each level of increase in pneumonia severity (x-factor), a patient's length of stay (y-factor) will increase by 1.090 days, with other variables held constant. When speech-language pathology is consulted, a patient's length of stay will increase by 1.294 days, with other variables held constant.

Question 3: Is there a difference in mortality when an SLP is not consulted?

A total of 173 patients expired (21.33% of the 811 patients). A total of 638 patients lived (78.67% of the 811 patients). A total of 109 patients or 32.73% of the *without SLP consultation* group (13.4% of the total 811 patients) expired. A total of 64 patients or 13.39% of the *with SLP consultation* group (7.9% of the total 811 patients) expired. A chi-square test showed a significant negative relationship between mortality and the presence of SLP consultation, X2 (1, N = 811) = 43.762, p =.000. If an SLP was not consulted, there were more incidences of death, and if an SLP was consulted, there were fewer deaths. A chart review of patient records indicated that within the group of those who received SLP consultations there were additional variables to consider. Of those patients that expired after receiving an SLP consultation, a portion received an SLP consultation for palliative care recommendations to allow them to eat and drink comfortably as their lives ended. Another portion of this group received an SLP consultation secondary to patient or family wishes for aggressive care despite terminal conditions.

Question 4: Is there a difference in morbidity when an SLP is not consulted?

Morbidity categories are the five different environments to which patients were discharged: (1) returned to pre-morbid status, (2) skilled nursing facility/rehabilitation, (3) home health, (4) hospice/death, or (5) long-term acute care. Figure 1 illustrates the number of patients in each discharge category, without and with SLP consultations. The largest percentage of patients receiving a speech-language pathology consultation was discharged to skilled nursing facilities or other rehabilitation units (n=180, 22.2%). The second highest category was returned to its previous condition (n=120, 14.8%). Without a speech-language pathology consultation, only 7.6% (n=62) of patients were discharged for further rehabilitation. A chi-square test showed a significant

relationship between morbidity and the presence/absence of speech-language pathology consultation, X2 (4, N = 811) = 65.903, p =.000. Speech-language pathology consultations were significantly associated with patients' final discharge status.

Figure 1 – Morbidity and SLP Consultations

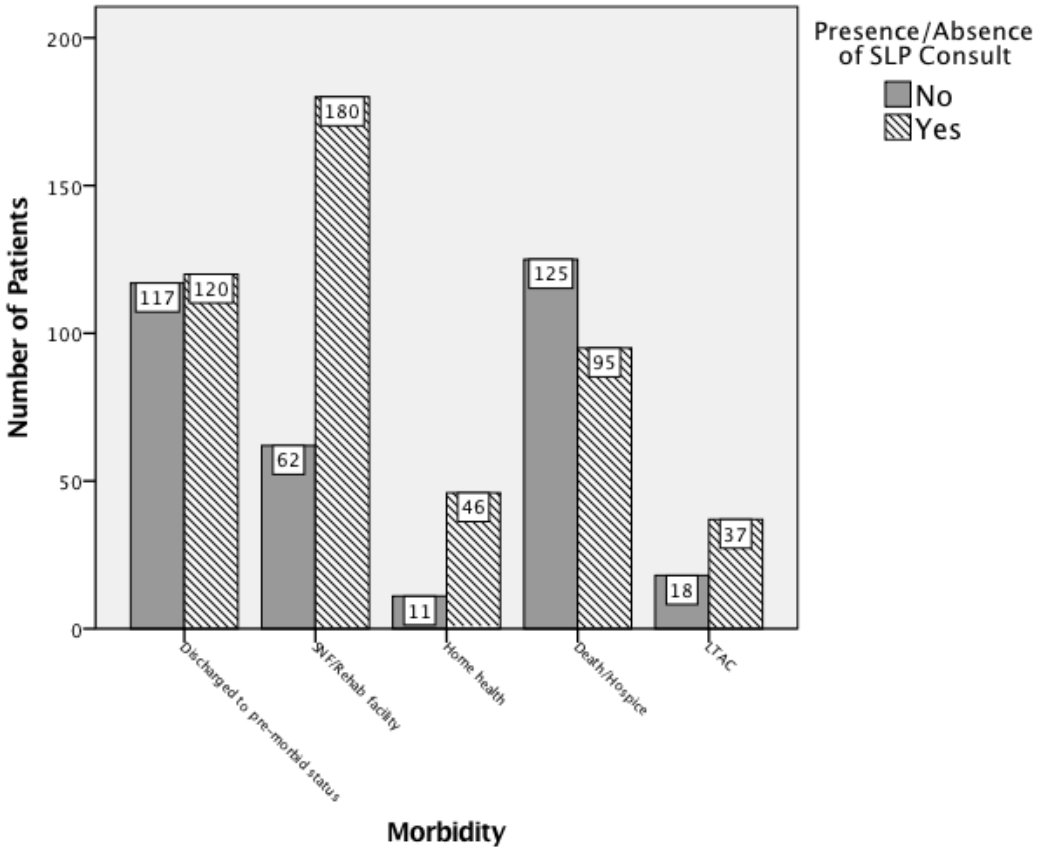

Figure 1 – Morbidity of aspiration pneumonia patients for each group: without SLP consultation and with SLP consultation. SNF=Skilled Nursing Facility; Rehab=Rehabilitation; LTAC=Long term acute care.

Question 5: How is morbidity related to pneumonia severity as measured by the CURB-65 score, and to the combined variables of pneumonia severity and SLP consultations for dysphagia?

The largest percentage of patients was discharged to a rehab facility (29.8% or 242 patients), followed by premorbid status, death/hospice, home health, and long-term acute care. The distribution of pneumonia severity as measured by the CURB-65 score was, from most severe to least severe: CURB-65 score of 5 (23.9% or 194 patients), score of 4 (35% or 284 patients, and the highest proportion of patients), score of 3 (23.9% or 194 patients), score of 2 (12.1% or 98 patients), score of 1 (4.4% or 36 patients), and score of 0 (0.6% or 5 patients). A chi-square test showed a significant relationship between morbidity and pneumonia severity: X2 (20, N = 811) = 193.870, p =.000. A patient's discharge location was related to an individual's pneumonia severity. This relationship is shown in Figure 2. The figure shows that as pneumonia severity increases, the proportion of patients discharged to premorbid status decreases (checked segments in the stacked bar graph), while the proportion discharged to further rehabilitation (including long term acute care), or to death/hospice, increases (gray and black boxes in the stacked bar graph).

Figure 2 – Morbidity and CURB-65 Scores

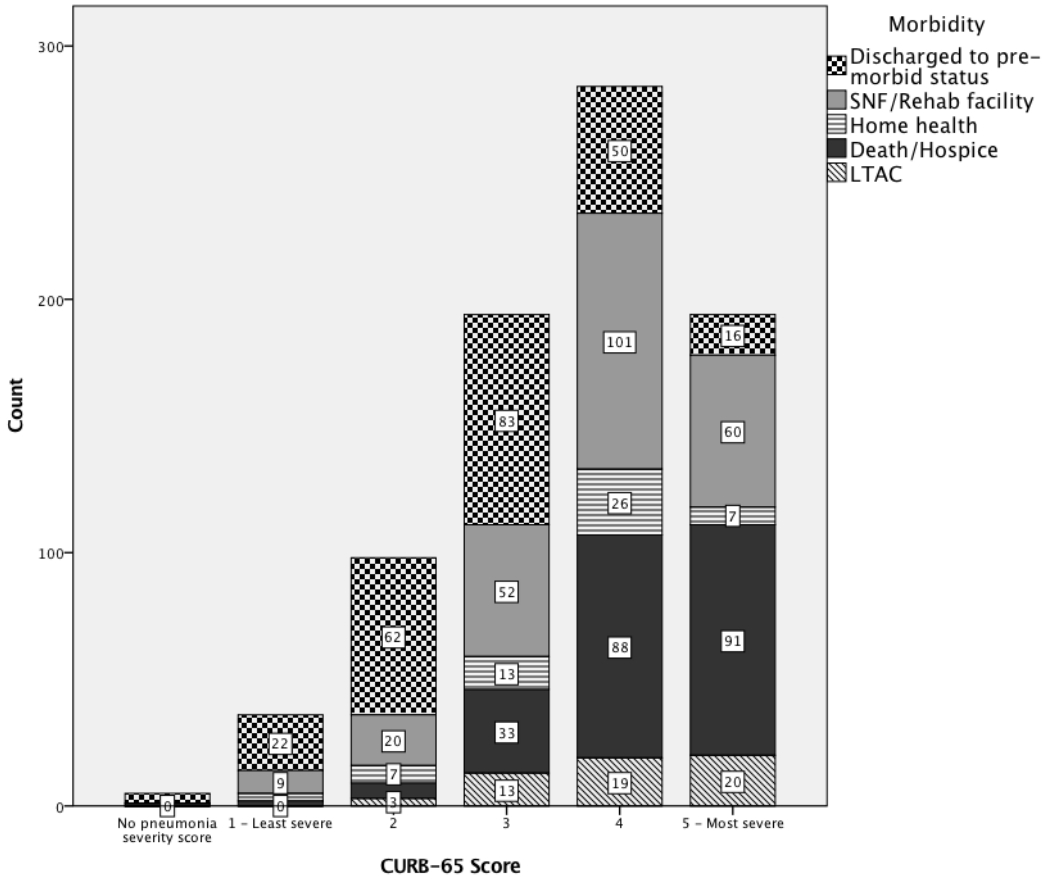

Figure 2 – Frequency of morbidity of aspiration pneumonia patients relative to the CURB-65 score. SNF=Skilled Nursing Facility; Rehab=Rehabilitation; LTAC=Long term acute care.

Table 2 shows the relationship among three variables: pneumonia severity, SLP consultation, and morbidity (discharge status). This relationship is illustrated in Figure 3. This figure breaks down the distribution of patients shown in Figure 2 into two groups: those who did not receive an SLP consultation (upper figure), and those who did (lower figure). Table 2 and Figure 3 show that at higher levels of pneumonia severity, patients who did not receive SLP consultation were associated with a greater likelihood of discharge to death or hospice care (black segments in the stacked bar graph), while those who received SLP consultations were more likely to be discharged to further rehabilitation (solid gray segments in the stacked bar graph). This is most clearly illustrated for patients with a CURB-65 score of 4. Of the 94 patients with a severity score of 4 who did not receive SLP consultation, 19% (18/94) were discharged for further rehabilitation, while 56% (53/94) died. Of the 190 patients who did receive SLP consultation, 43% (83/190) were discharged to rehabilitation, while 18% (35/190) died. Similar patterns of discharge are seen at pneumonia levels 5 and 3.

Table 2: ***Frequencies and Percentages of Morbidity Scores/CURB-65 Scores Relative to SLP Consultations***

SLP Consultation	Morbidity		CURB-65 Score: No pneumonia score	1 – Least Severe	2	3	4	5 – Most Severe	Total
No	Discharged to pre-morbid status	Count	3	13	40	40	15	6	117
		% within morbidity	2.6%	11.1%	34.2%	34.2%	12.8%	5.1%	100%
	SNF/Rehab facility	Count	0	5	16	15	18	8	62
		% within morbidity	0.0%	8.1%	25.8%	24.2%	29.0%	12.9%	100%
	Home health	Count	1	2	3	0	5	0	11
		% within morbidity	9.1%	18.2%	27.3%	0.0%	45.5%	0.0%	100%
	Death/Hospice	Count	0	1	4	20	53	47	125
		% within morbidity	0.0%	0.8%	3.2%	16.0%	42.4%	37.6%	100%
	LTAC	Count	0	0	2	6	3	7	18
		% within morbidity	0.0%	0.0%	11.1%	33.3%	16.7%	38.9%	100%
	Total	Count	4	21	65	81	94	68	333
		% within morbidity	1.2%	6.3%	19.5%	24.3%	28.2%	20.4%	100%

Table 2 - continued

Frequencies and Percentages of Morbidity Scores/CURB-65 Scores Relative to SLP Consultations

SLP Consultation	Morbidity		CURB-65 Score: No pneumonia score	1 – Least Severe	2	3	4	5 – Most Severe	Total
Yes	Discharged to pre-morbid status	Count	1	9	22	43	35	10	120
		% within morbidity	0.8%	7.5%	18.3%	35.8%	29.2%	8.3%	100%
	SNF/Rehab facility	Count	0	4	4	37	83	52	180
		% within morbidity	0.0%	2.2%	2.2%	20.6%	46.1%	28.9%	100%
	Home health	Count	0	1	4	13	21	7	46
		% within morbidity	0.0%	2.2%	8.7%	28.3%	45.7%	15.2%	100%
	Death/Hospice	Count	0	1	2	13	35	44	95
		% within morbidity	0.0%	1.1%	2.1%	13.7%	36.8%	46.3%	100%
	LTAC	Count	0	0	1	7	16	13	37
		% within morbidity	0.0%	0.0%	2.7%	18.9%	43.2%	35.1%	100%
	Total	Count	1	15	33	113	190	126	478
		% within morbidity	0.2%	3.1%	6.9%	23.6%	39.7%	26.4%	100%

Table 1 - continued

Frequencies and Percentages of Morbidity Scores/CURB-65 Scores Relative to SLP Consultations

SLP Consultation	Morbidity		CURB-65 Score: No pneumonia score	1 – Least Severe	2	3	4	5 – Most Severe	Total
Total	Discharged to pre-morbid status	Count	4	22	62	83	50	16	237
		% within morbidity	1.7%	9.3%	26.2%	35.0%	21.1%	6.8%	100%
	SNF/Rehab facility	Count	0	9	20	52	101	60	242
		% within morbidity	0.0%	3.7%	8.3%	21.5%	41.7%	24.8%	100%
	Home health	Count	1	3	7	13	26	7	57
		% within morbidity	1.8%	5.3%	12.3%	22.8%	45.6%	12.3%	100%
	Death/Hospice	Count	0	2	6	33	88	91	220
		% within morbidity	0.0%	0.9%	2.7%	15.0%	40.0%	41.4%	100%
	LTAC	Count	0	0	3	13	19	20	55
		% within morbidity	0.0%	0.0%	5.5%	23.6%	34.5%	36.4%	100%
	Total	Count	5	36	98	194	284	194	811
		% within morbidity	0.6%	4.4%	12.1%	23.9%	35.0%	23.9%	100%

Note. SNF=Skilled Nursing Facility; Rehab=Rehabilitation; LTAC=Long term acute care.

Figure 3 – Morbidity, CURB-65 Scores and Consultations

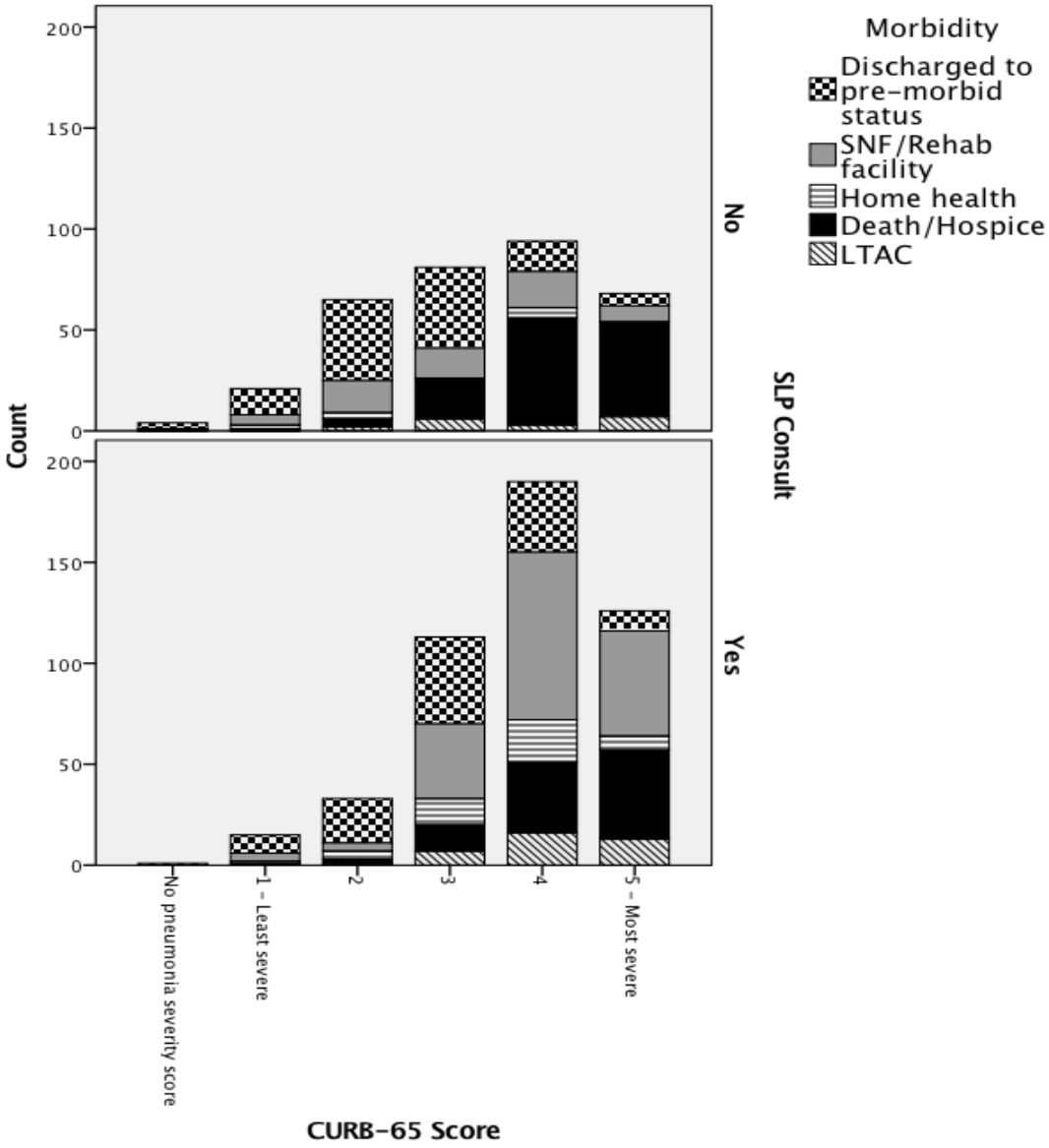

Figure 3 – Frequency of morbidity of aspiration pneumonia patients for each group (without SLP consultation and with SLP consultation) relative to the CURB-65 score. SNF=Skilled Nursing Facility; Rehab=Rehabilitation; LTAC=Long term acute care.

A three-way chi-square test across all morbidity and severity groups confirmed a significant relationship among morbidity categories, pneumonia severity, and presence/absence of an SLP consultation (X2 (20, N = 811) = 193.870, p =.000). Just within the group of patients who did *not* receive an SLP consultation, the chi-square test showed a significant relationship between morbidity category and pneumonia severity (X2 (20, N = 333) = 127.069, p =.000). Patients in the lower severity categories were more likely to be discharged home (pre-morbid status), while patients in the highest severity categories were more likely to die. Just within the group of patients who *did* receive an SLP consultation, the chi-square test showed a significant positive relationship between morbidity category and pneumonia severity (X2 (20, N = 478) = 97.885, p =.000). Patients in higher severity categories were less likely to die, and more likely to be discharged to skilled nursing facility/rehabilitation facility.

Question 6: Is the proportion of speech-language pathology consultations greater in the geriatric population?

In the non-geriatric group, 50.5% (214/424 patients) did not receive a consultation versus 49.5% (210/424 patients) who did receive a consultation. In the geriatric group, 30.7% (119/387 patients) did not receive a consultation versus 69.2% (268/387 patients) who did receive a consultation. A chi-square test showed a significant relationship between age and the presence/absence of speech-

pathology consultation, X2 (1, N = 811) = 32.519, p =.000. Geriatric patients were significantly more likely to get a consultation than non-geriatric patients.

Question 7: Is the proportion of speech-language pathology consultations greater in the male or female population?

Of the total number of patients, 61.9% (502/811) were male and 38.1% (309/811) female. Of those who received an SLP consultation, a larger proportion was male (38.2% male versus 20.7% female). A chi-square test showed a significant relationship between gender and the presence/absence of SLP consultation, X2 (1, N = 811) = 4.309, p =.038. Males were significantly more likely to receive an SLP consultation than females.

Question 8: Does a higher pneumonia severity (CURB-65) score relate to whether speech-language pathology is consulted?

Figure 4 shows that the three lowest pneumonia severity scores (CURB-65 scores of "0," "1," and "2") were less likely to get an SLP swallowing consultation. The three highest severity scores (CURB-65 scores of "3," "4," and "5") were more likely to get a consultation. A Spearman rank-order correlation indicated a significant positive relationship between consultation and pneumonia severity (rs=.182, p=.000). The more severe a patient's pneumonia was at admission, the greater the likelihood of a speech-language pathology consultation.

Figure 4 – CURB-65 Score Categories and SLP Consultations

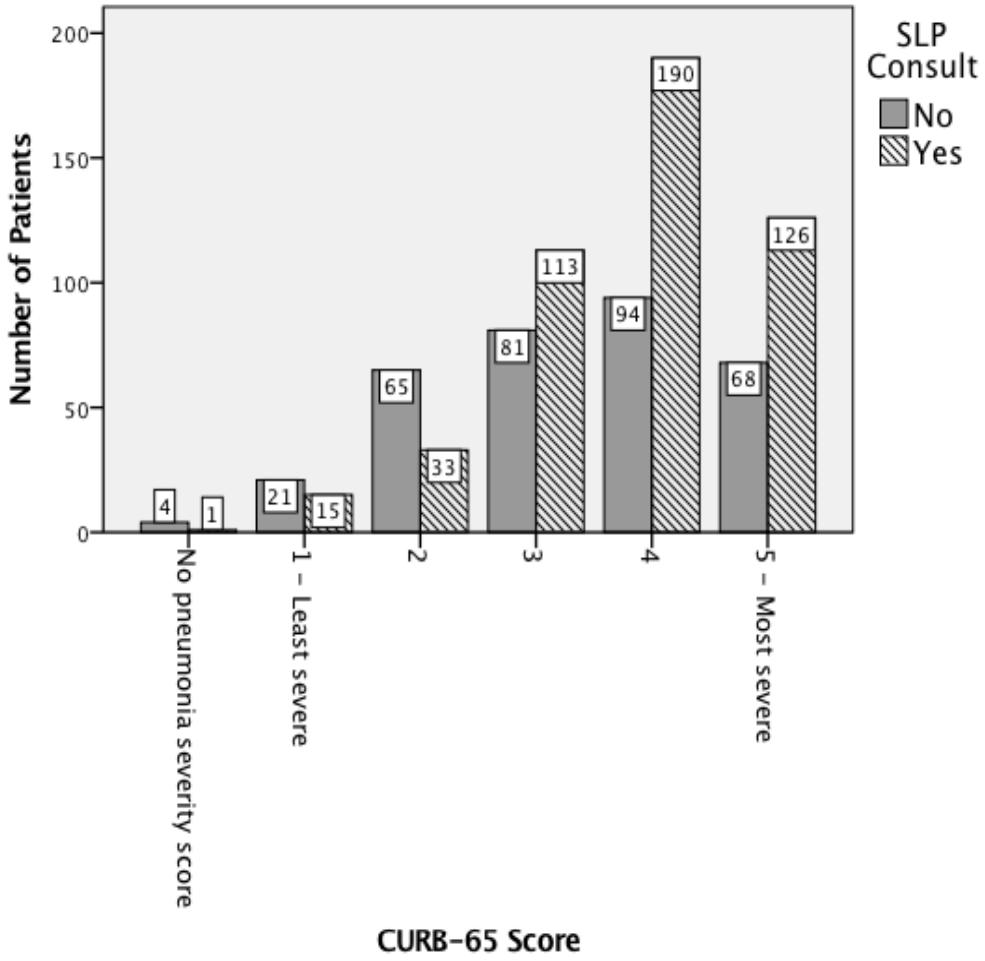

Figure 4 - Numbers of patients for each CURB-65 score category relative to the presence/absence of speech-language pathology consultation

Question 9: Is there a greater frequency of 30-day hospital readmissions for patients with aspiration pneumonia who do not receive a speech-language pathology consultation?

Two hundred twenty-one patients were re-admitted to the hospital within 30 days of initial discharge, while 590 were not. Table 3 shows the totals and percentages for the presence and absence of readmission and the presence/absence of SLP consultation. Within each re-admission category, more patients received an SLP consultation for swallowing than did not. Also, within each readmission category, the proportions of those receiving and not receiving an SLP consultation were approximately the same. For example, in the no re-admission category, 58.5% of patients received a consultation, while in the yes re-admission category, 60.2% received an SLP consultation. This suggests no clear pattern of association between SLP consultations and re-admission. A chi-square test showed no significant relationship between readmission and the presence/absence of speech-language pathology consultation, X2 (1, N = 811) = .193, p=.660.

Table 3: ***Frequencies and Percentages of Readmissions and SLP Consultations***

		Speech-Language Pathology Consultation		
Readmission		No	Yes	Total
No	Count	245	345	590
	% within readmission	41.5%	58.5%	100%
	% of total	30.2%	42.5%	72.7%
Yes	Count	88	133	221
	% within readmission	39.8%	60.2%	100%
	% of total	10.9%	16.4%	27.3%
Total	Count	333	478	811
	% within readmission	41.1%	58.9%	100%
	% of total	41.1%	58.9%	100%

4. Discussion

Links between individuals with aspiration and pneumonia have been documented in several studies (Altman, Gou-Pei, & Schaefer, 2010; Guyomard, Fulcher, Redmayne, Metcalf, Potter, & Myint, 2009; Macht, Wimbish, Bodine, & Moss, 2013). Since speech-language pathologists are currently trained to diagnose and treat aspiration resulting from dysphagia (especially in acute care settings), the current study sought to examine outcomes of SLP referrals for aspiration related (i.e., dysphagia related) pneumonia. Our hope was that results could validate or challenge current hospital practice patterns related to SLP consultation for dysphagia. This study extends the results of a previous study (Bolinger & Dembowski, in review) that looked at outcomes of SLP referrals for dysphagia in an acute care facility across all pneumonia types over one year. That study found that SLPs were consulted on less than one-third of patients across all pneumonia types, with aspiration pneumonia the category for which SLPs were most frequently consulted. The current study found that SLPs were consulted on two-thirds of the total aspiration pneumonia patients over three years. Since aspiration is, by definition, related to dysphagia, we might expect that all aspiration pneumonia patients would routinely be referred to speech pathology for evaluation, but this is not the case.

Question 1 examined the relationship between the length of stay (LOS) and SLP consultation. Longer LOS was significantly associated with SLP consultation. This suggests that SLP consultations occurred on the most ill patients. This requires documenting the relationship between LOS and pneumonia severity, and the relationship between SLP consultation and pneumonia severity. Question 2 examined the relationship of LOS to pneumonia severity as indicated by the CURB-65 score, and to the combined variables of pneumonia severity and SLP consultation. Both severity and SLP consultation were significantly associated with longer LOS. The more severe the pneumonia, the longer the patient was in the hospital. The longer a patient was in the hospital, the greater the opportunity for doctors, nurses or other medical staff to note overt signs of dysphagia, and to call for an SLP referral.

Multiple regression suggested that pneumonia severity and speech-language pathology consultations both predicted increases in length of stay. Pneumonia severity accounted for 6% of the variability in the model. SLP consultation accounted for 10% of variability. The combined effect of both variables accounted for 19.5% of the variability. The CURB-65 scale produces ranked numeric values ranging from least severe to most severe. Model coefficients indicated that for each level of increase in pneumonia severity, there was an increase in 1.09 days of stay. Therefore, an individual that ranked a "1" on the CURB-65 scale had an increased length of stay of 1.09 days (1.09 days x severity of 1) while a patient with a CURB-65 score of "5" would have an increased length of stay of 5.45 days (1.09 days x severity of 5). If a speech-language pathologist were consulted on either patient, an additional 1.294 days would be added to the patient's length of stay. This seems logical in that speech-language pathology has 24 hours to complete a consultation. Also, if the SLP recommended additional rehabilitation, a social worker would have to coordinate care after discharge and coordination of care following discharge may increase the overall length of stay.

Question 3 examined the relationship between SLP consultation and mortality. Mortality was significantly higher in the group that did not receive SLP consultation. This contrasts with results of Bolinger & Dembowski (in review) which did not find a relationship between SLP consultation and mortality across all types of pneumonia. The difference may be that the current study looked only at aspiration pneumonia, for which SLPs were consulted more frequently and therefore a relationship with SLP consultation might be more likely to emerge. Also, Komiya et al. (2013) found that persons with aspiration pneumonia had higher 30-day mortality rates than those with other types of pneumonia. One clarifying point to the mortality rate in this study is the practice pattern of the hospital in which the data were collected. The facility's speech-language pathology department is active in the palliative care unit. Terminal patients here have opted for comfort measures only. As a means of improving quality of life during end-of-life care, patients may eat or drink despite aspiration and this, in turn, may increase mortality rate. Therefore, mortality rates do not accurately reflect the number of patients that expired or survived secondary to actively treated aspiration pneumonia, but *excluding* those who received SLP consultations for palliative care.

Question 4 examined the relationship of morbidity to SLP consultation, where morbidity was defined as category of hospital discharge disposition. A larger number of patients with an SLP consultation were discharged to skilled nursing facilities or inpatient rehabilitation programs. This suggests that SLP involvement contributes to qualifying individuals for further rehabilitation post discharge from an acute-care facility. Most rehabilitation facilities require referrals from two of the three therapy disciplines (physical, occupational, and speech) for acceptance to the facilities. Severe respiratory distress may impair movement, triggering one referral from physical or occupational therapy, while the SLP evaluation of feeding/swallowing problems may provide the additional recommendation for continued therapy as a qualifier for admission to a skilled nursing facility or inpatient rehabilitation facility.

Question 5 looked at how morbidity (discharge disposition) related to the combination of pneumonia severity and SLP consultation. Greater pneumonia severity led to a greater number of SLP consultations. In the consultation group, more individuals were referred for additional rehab at discharge. However, a large number of individuals with the same severity level that did *not* receive an SLP consultation were discharged to hospice or died. Therefore, both severity of pneumonia and the presence of an SLP consultation had a significant impact on patients' morbidity. This suggests a chain of events related to pneumonia severity, SLP consultations, and morbidity. If a patient was admitted with a higher severity of pneumonia, an SLP consultation was more likely to occur. After the consultation, it was more likely the patient would be discharged to premorbid status or a rehabilitation facility for additional therapy. However, if no consultation occurred, there was a greater likelihood of death, specifically with a pneumonia severity rating of 4 and 5.

Question 6 examined the relationship between SLP consultation and age, with age defined categorically as geriatric or non-geriatric. Geriatric patients with aspiration pneumonia were more likely to receive SLP dysphagia consultations than non-geriatric patients. This result is consistent with Bolinger & Dembowski (in review). This is also consistent with Daniels et al. (2004) who found that persons are more prone to upper airway penetration with increased age.

Question 7 examined the relationship between SLP consultation and gender. Males with pneumonia were more likely to receive consultations than females. This is consistent with the previous Bolinger & Dembowski study. The relationship of gender to patterns of medical care is complex. Males and females may be inclined to use different types of medical services (Evashwick et al., 1984; Weiss & Lonnquist, 2012). A variety of social and cultural factors (e.g., expectations concerning caregiving or financial support) may influence how males and females behave in medical settings, and how they are treated by medical providers. A closer look at gender and speech pathology services in the acute care setting is in preparation.

Question 8 looked at the relationship of pneumonia severity to SLP consultation. Patients with more severe pneumonia were more likely to receive a speech-language pathology consultation. This makes intuitive sense since the more severe the respiratory dysfunction, the greater chance of the patient demonstrating overt signs and symptoms of swallow dysfunction. The category of

pneumonia severity which received the greatest number of SLP consultations was the CURB-65 score of "4." One might expect the group scoring a "5" to receive a greater number of SLP consultations; however, the more severe a person's pneumonia, the greater the chance the person would require external respiratory support. When a patient is on mechanical ventilation, a speech-language pathology consultation is not appropriate as the patient is unable to take food, liquids, or medications by mouth. Therefore, it is more likely that patients with a slightly less severe case of pneumonia not requiring ventilation would be the highest group receiving an SLP consultation.

Question 9 examined the relationship between 30-day hospital readmissions for patients with aspiration pneumonia and SLP consultations. No significant relationship was found.

Recall that of the 811 total aspiration pneumonia patients, over 40% received no dysphagia consultation, though, by definition, the aspiration pneumonia of all these patients was likely related to swallow dysfunction, and so all patients might have benefited from SLP swallow evaluation. If physicians capitalized on the expertise of speech-language pathologists in swallow dysfunction, they might improve efficiency and increase patient turnover by preventing further exacerbation of the current condition or future pneumonia events. If the patient gets better and does not have to be re-admitted, this saves the physician time and allows time to see other patients. Patients re-admitted to the hospital despite speech-language pathology consultations may have returned due to patient compliance with recommendations, receiving-facility compliance with recommendations, and/or changes in swallow function secondary to changes in medical status. Hospitals cannot prevent receiving-facilities from feeding unsafe patients or prevent patients from feeding themselves. Though the hospital has no control over this, a re-admission due to receiving-facility or patient lack of compliance with medical recommendations is not a consideration regarding third-party payer reimbursements to the hospital, nor considered by governing and accreditation bodies.

4.1 Strengths, weaknesses and future research

A strength of this study is the number of records evaluated and the length of time covered. A total of 811 patient records were evaluated covering a period of more than 3 years. The large sample size allowed for confident statistical analysis. A weakness of the study is the lack of data regarding co-morbidities present in patients admitted with aspiration pneumonia. Patient co-morbidities would certainly have influenced length of stay, and could affect decision making about whether or not to order an SLP consultation. It might also be useful to know to what extent feeding recommendations might be followed post-discharge. This might be particularly helpful in identifying factors related to hospital re-admission. Finally, it would be useful to know when, during a patient's hospital stay, an SLP consultation occurred, and what impact that might have had on the length of stay and on re-admission. For the present study it was possible to identify the presence of an SLP consultation but knowing the timing of that consultation over the course of patients' hospital stay, or knowing what services were administered in cases of multiple SLP visits, posed challenges. It would be useful to know whether outcomes improve if an SLP is consulted at admission rather than later in the stay, or at discharge.

Statements and Declarations

Funding: This research received no external funding

Conflicts of Interest: The authors declare no conflict to interest.

Acknowledgments: We would like to acknowledge the Texas Tech Health Sciences Center Clinical Research Institute for assisting with IRB protocol development and submission, in addition to statistical support. Additionally we would like to acknowledge Dr. Rajinder Koul, Dr. Melinda Corwin, Dr. Rubini Pasupathy, and Dr. Jennifer Hanners-Guitierrez for their support and guidance.

Ethical approval : The Texas Tech University Health Sciences Center Institutional Review Board approved the study (IRB# L15-056).

Informed consent : A waiver of informed consent was approved in accordance with 45CFR 46.116(d) and 46.164.512(i)(1)(iii).

ORCID ID: Christopher Bolinger https://orcid.org/0000-0002-9203-2178

References

[1] Altman, K. W., Yu, G. P., & Schaefer, S. D. (2010). Consequence of dysphagia in the hospitalized patient: Impact on prognosis and hospital resources. *Archives of Otolaryngology–Head & Neck Surgery*, *136*(8), 784-789.

[2] ASHA. (2002). *Knowledge and skills needed by speech-language pathologists providing services to individuals with swallowing and/or feeding disorders*. Retrieved April 4, 2015, from http://www.asha.org/policy/KS2002-00069/

[3] Bolinger, C. & Dembowski, J. (2022). Impact of speech-language pathology consultations on patients with pneumonia in an acute-care hospital setting. Manuscript under review.

[4] Daniels, S., Corey, D., Hadskey, L., Legendre, C., Priestly, D., Rosenbek, J., & Foundas, A. (2004). Mechanism of sequential swallowing during straw drinking in healthy young and older adults. *Journal of Speech, Language, and Hearing Research*, *47*(1), 33-45.

[5] Evashwick, C., Rowe, G., Diehr, P., & Branch, L. (1984). Factors explaining the use of health care services by the elderly. *Health Services Research,* 19(3), 357.
[6] Guyomard, V., Fulcher, R. A., Redmayne, O., Metcalf, A. K., Potter, J. F., & Myint, P. K. (2009). Effect of dysphasia and dysphagia on inpatient mortality and hospital length of stay: A database study. *Journal of the American Geriatrics Society*, *57*(11), 2101-2106.
[7] IBM Corp. (2016). IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.
[8] Komiya, K., Ishii, H., Umeki, K., Mizunoe, S., Okada, F., Johkoh, T., & Kadota, J. I. (2013). Impact of aspiration pneumonia in patients with community-acquired pneumonia and health care-associated pneumonia: A multicenter retrospective cohort study. *Respirology, 18*(3), 514-521.
[9] Lim WS, van der Eerden MM, Laing R, Boersma WG, Karalus N, Town GI (2003). Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. *Thorax 58*:377-82
[10] Macht, M., Wimbish, T., Bodine, C., & Moss, M. (2013). ICU-acquired swallowing disorders. *Critical care medicine*, *41*(10), 2396-2405.
[11] Medicode. (1996). *ICD-9-CM: International classification of diseases, 9th revision, clinical modification*. Salt Lake City, Utah: Medicode.
[12] US Library of Medicine. (2015). *Aspiration pneumonia: MedlinePlus Medical Encyclopedia*. Retrieved May 11, 2015, from http://www.nlm.nih.gov/medlineplus/ency/article/000121.htm
[13] Weiss, G., & Lonnquist, L. (2012). *The sociology of health, healing, and illness* (2nd ed.). Upper Saddle River, N.J.: Prentice Hall.