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Predictors of Emergent Feeding Tubes and Tracheostomies in Amyotrophic Lateral Sclerosis (ALS)

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Abstract

Objective—Predictable decline in ALS makes unplanned gastrostomy and tracheotomy avoidable. We determined whether gastrostomy or tracheostomy insertion during emergent hospitalization is associated with patient or hospital characteristics, changed Medicare policy in 2001, or proximity to specialized ALS care.

Methods—We performed a retrospective analysis of hospitalizations and procedures for ALS/MND patients in Pennsylvania between 1996–2009. We identified predictors of gastrostomy/tracheotomy during emergent hospitalization and trends over time.

Results—Patients underwent 1,748 gastrostomies and 373 tracheotomies. 32% of gastrostomies and 67% of tracheostomies were placed emergently. Emergent hospitalizations involving gastrostomy were more expensive with fewer home discharges. Blacks and Medicaid patients had higher odds of emergent gastrostomy placement. Conversely, academic hospital affiliation decreased odds of emergent gastrostomy or tracheostomy placement (AOR 0.49, AOR 0.37, $p < 0.001$). After Medicare policy changes, gastrostomy use increased, while emergent gastrostomies decreased. Surprisingly, proximity to specialized care was associated with increased emergent gastrostomy placement.

Conclusions—Blacks and Medicaid patients were more likely to undergo emergent gastrostomy insertion. Patients receiving gastrostomy during emergent admissions had fewer home discharges and higher costs. Academic hospital affiliation decreased odds of emergent gastrostomy or tracheostomy. After Medicare changes broadening access, while gastrostomy use increased, the proportion of emergent procedures decreased.

Keywords

gastrostomy; tracheostomy; communication; costs; health policy

Introduction

Amyotrophic lateral sclerosis (ALS) and its variants, collectively known as motor neuron disease (MND) offer a unique model for studying two critical and common end-of-life decisions: placement of feeding tube (gastrostomy) and tracheostomy. Because ALS/MND patients experience predictable progression unplanned gastrostomies and tracheostomies suggest inappropriate delays in decision-making. Anticipatory shared decision-making is crucial to making end-of-life care patient-centered and timely, two dimensions of quality established by the Institute of Medicine.(1) Well-timed discussions allow patients and providers to chart a course reflecting patient wishes and can lead to fewer life-sustaining procedures, lower costs and improved quality of life for patients.(2, 3)

Illuminating factors associated with unplanned feeding tubes and tracheostomies may suggest causes of delayed decision-making as well as offer the opportunity to evaluate two notable shifts affecting ALS/MND patients over the past decade. First, multidisciplinary, specialized ALS clinics have become a dominant paradigm for care, improving quality through decreased unplanned hospital admissions, higher quality of life and potentially lengthening survival in European health systems.(4–6) However, their effects on quality have not been investigated in the United States. Second, after July 2001, the Benefits Improvement Protection Act (BIPA) significantly shortened the waiting period for Medicare eligibility in ALS patients qualifying based on disability from 29 to 6 months.(7) Although access to regular care at earlier stages of clinical progression may have allowed improved timely decision-making for gastrostomy and tracheostomy, the impact of this policy has not been described.

Using a large, statewide dataset we sought to 1) describe what proportion of gastrostomies and tracheostomies occur in the context of emergent hospitalization, a plausible marker for lack of planning for these procedures, 2) compare outcomes (clinical and cost) for emergent and non-emergent procedures, and 3) identify patient or hospital qualities associated with fewer emergent procedures. Specifically, we examined the effects of race, insurance and hospital academic affiliation, proximity to specialized ALS/MND care and improved Medicare access subsequent to BIPA on placement of emergent gastrostomies and tracheostomies.

Methods

We performed a retrospective study of hospitalizations, gastrostomies and tracheotomies performed in ALS/MND patients in Pennsylvania between 1996 and 2009. We used data from the Pennsylvania Health Care and Cost Containment Council (PHC4) which contains records from all hospitalizations and ambulatory surgical centers within Pennsylvania, except VA medical centers. ALS/MND patients were identified using ICD-9 codes (335.20, 335.21, 335.22, 335.23, 335.24, 335.29). Gastrostomy and tracheostomy procedures were identified using standard ICD-9 and CPT-4 codes, and principal diagnoses were identified using Clinical Classification Software (CCS) criteria.

Outcome variables

Our primary outcome variable was emergent (versus non-emergent) placement of gastrostomy or tracheostomy. To define this variable we used PHC4's classification of admissions as emergent, urgent or elective based on acuity and risk of mortality on admission. In addition, we classified feeding tubes and tracheostomies placed at ambulatory surgical centers as elective. To confirm the validity of these three categories, we verified that most emergent admissions occurred from the ER without predilection for any day of the week; conversely, few urgent or elective admissions had weekend or ER admissions (Supplemental Table 1). Using this classification, we created a dichotomous variable of emergent vs. non-emergent (urgent/elective) for all admissions and procedures.

Patient and Hospital Characteristics

We used 2000 US Census data to measure each patient's median ZIP code income (as a marker of socioeconomic status) and rural/urban location.⁽⁸⁾ To adjust for co-morbidities, we used the Elixhauser method, which assigns co-morbid conditions to 30 categories.⁽⁹⁾ Of these 30, we omitted paralysis, neurologic abnormalities, and electrolyte disturbance, as these could reflect ALS/MND related conditions also associated with emergent admission. Academic affiliation for hospitals was determined using the American Hospital Association survey.

Proximity to specialized care

Online searches and information from the ALS association identified eight medical facilities offering specialized multidisciplinary care for ALS/MND in Pennsylvania. Location, size, services and start dates were confirmed by phone conversation with a clinic physician or staff. Proximity to specialized ALS/MND care was determined by calculating the direct distance from each patient's home zip code to the closest specialized facility. As Philadelphia and Pittsburgh each contain two distinct ALS clinics, in our analysis, distances were calculated from the larger clinic (based on self-reported number of patients followed): the University of Pittsburgh Medical Center (Pittsburgh) and the ALS Center at Pennsylvania Hospital (Philadelphia).

Data cleaning

We excluded admissions to psychiatric, rehabilitation and long term acute care (LTAC) facilities (n= 517). Patients younger than 20 (n= 164) and admissions coded as trauma (n =

3) or newborn (n=5) were also excluded. Sixty admissions missing a unique patient identifier and admissions lacking categorization as emergent, urgent or elective were also dropped (n = 11). For patients with multiple admissions involving gastrostomy (n=49) or tracheostomy (n=1), we included the first admission and excluded subsequent admissions.

Analysis

We used Stata 11.0 statistical software for all analyses. We used t-tests (for continuous variables) and χ^2 tests (for categorical data) to determine if emergent and non-emergent hospitalizations involving gastrostomy or tracheostomy differed inpatient disposition, length of stay and costs. Linear regression was used to identify trends in the annual number of gastrostomies and tracheostomies placed. All statistical tests were two-sided and statistical significance was set at $p < 0.05$. Using χ^2 we tested for association between emergent versus non-emergent context for gastrostomy or tracheostomy placement and variables of interest including patient race, insurance, proximity to specialized ALS care, BIPA implementation.

Using multivariate logistic regression with stepwise forward selection we identified predictors of gastrostomy or tracheostomy placement during emergent (versus non-emergent) admissions. Candidate predictors were retained in the model for p value < 0.25 , and age, income and co-morbidities were forced back into the final models if not already included. We tested the effects of patient characteristics including age, sex, race/ethnicity, insurance type, and proximity to specialized care. We also evaluated hospital characteristics (size and academic affiliation) and implementation of BIPA.

We hypothesized that BIPA would provide earlier Medicare access for patients qualifying based on disability (<65) leading to 1) increased overall numbers of gastrostomies and tracheostomies and 2) more planned (i.e. fewer emergent) procedures. Therefore, we examined trends in annual gastrostomies and tracheostomies performed in Medicare patients <65 (newly eligible) before and after BIPA compared to patients >65 , who were unaffected by the legislation. We also looked for trends in the proportion of emergent/non-emergent procedures for newly eligible patients (Medicare, <65), all patients <65 , and patients >65 .

Results

Between 1996 and 2009, ALS/MND patients underwent 11,050 hospitalizations, 1,748 gastrostomies and 373 tracheostomies. These 11,050 hospitalizations represent 5,759 patients. 9,387 of these hospitalizations were inpatient admissions with the most frequent primary diagnoses (aside from ALS/MND) of aspiration (6.8%), respiratory failure (5.5%) and pneumonia (4.2 %). Of all hospitalizations, 53% (5,860) were emergent, 21% (2,290) were urgent and 26% (2,900) were elective.

Thirty-two percent (n=554) of gastrostomies and 67% (n=248) of tracheostomies were placed during emergent hospitalizations (Figure 1). For 161 patients receiving both tracheostomy and gastrostomy, 65.2% (n=105) of these admissions were emergent. The overall number of inpatient hospitalizations, gastrostomies and tracheostomies per year did not significantly change over this 14 year period (test for trend, $p=0.7$, $p=0.7$).

Demographics for patients undergoing gastrostomy and tracheostomy placement are presented in Table 1. Of 1,748 patients receiving gastrostomy, 50.1% were male, 81.2% were white and 7.2% were black. The mean age was 66.4 years and the majority (n=1077, 62%) lived <30 miles away from a clinic offering specialized multidisciplinary ALS care. The most common primary payer was Medicare (62%) followed by private insurance (32%) and Medicaid (3.5%). Of 373 patients receiving tracheostomy, 59.8% were male, 77.2% were white and 13.9% were black. The mean age was 61.2 years and 51.7% had Medicare, followed by private insurance (39.4%) and Medicaid (7%).

Of 1,748 gastrostomies, 76.1% (1,331) were placed during inpatient admissions and 23.9% (417) in outpatient settings. Gastrostomies inserted in outpatient ambulatory surgical centers significantly increased from 10% to 32.5% from 1996 to 2009 ($p=0.011$). Outpatient gastrostomies were significantly less expensive ($\$2,998 \pm 3544$) even compared to elective inpatient gastrostomies ($\$14,415 \pm 57,655$), despite similar patient age and co-morbidity profiles.

There were clear differences between gastrostomies placed during emergent and non-emergent hospitalizations (Table 2). Although only a small percentage (n=64, 3.7%) of these admissions resulted in death, the majority of deaths (n=41, 64%) occurred during an emergent admission. These patients had significantly longer lengths of stay, higher in-house mortality and more expensive hospitalizations when compared with non-emergent hospitalizations for gastrostomy. Similarly, while in-house mortality was only 9.1% (n=34) for admissions with tracheostomy, 74% of these occurred during an emergent admission. However, length of stay and cost did not differ for emergent vs. non-emergent tracheostomies (Table 2).

Bivariate analysis

Bivariate analysis revealed that of patients receiving gastrostomy, blacks were more likely to undergo emergent placement (52%) compared to whites (31.6%), ($p < 0.001$). Privately insured patients underwent emergent placement (21.1%) far less than Medicare (35.9%) or Medicaid patients (57.4%), $p < 0.001$. Likewise for tracheostomies, privately insured patients were less likely to have an emergent procedure (56.5%) compared to patients with Medicare (73.1%) or Medicaid (73.1%), $p = 0.02$. However, race did not significantly differ for patients undergoing emergent vs. non-emergent tracheotomy.

Effects of BIPA

Among newly eligible patients (Medicare, age <65), annual gastrostomies significantly increased from 4.2 to 16.1 gastrostomies per year after implementation of BIPA ($t = -5.8$, 11 df, $p < 0.001$, Figure 2). In contrast, annual gastrostomies remained stable or fell in patients unaffected by the legislation (patients >65), suggesting this rise among newly eligible Medicare patients did not merely reflect a general increase in gastrostomy placement for all patients during this time. Notably, the number of non-emergent gastrostomies performed annually in newly eligible patients significantly increased from 2.8 to 11.6 after BIPA ($t = -6.6$, 11 df, $p < 0.001$).

The proportion of emergent gastrostomies fell roughly 6% for both patients <65 and >65. In patients <65, emergent gastrostomies decreased from 28.2% to 23% after BIPA ($p=0.13$), resulting from a small decrease in annual emergent gastrostomies along with a rise in annual non-emergent gastrostomies. Although the proportion of emergent gastrostomies in older patients (age >65) also declined during this period (40% to 33.2%, $p=0.02$), because annual gastrostomies actually declined over this time, this reduction resulted from decreases in both emergent and non-emergent gastrostomy, with emergent gastrostomies falling faster than non-emergent. Therefore, although the proportion of emergent gastrostomies declined in both populations, for patients <65, this decline was due to a surge in the number of non-emergent gastrostomies, consistent with a significant rise among newly eligible patients due to BIPA.

Annual tracheostomies in newly eligible patients similarly increased after BIPA (0.6 to 5.4, $t = -6.7$, 11 df, $p < 0.001$), in contrast to stable or declining numbers in patients > 65 (Supplemental Figure 1). However, the majority of tracheostomies for newly eligible patients were performed emergently, suggesting that, unlike gastrostomy, increased access due to BIPA did not decrease the proportion of emergent tracheostomies.

Predictors of emergent gastrostomy/tracheostomy placement

Results from our multivariate logistic regression adjusting for age, income and co-morbidities are shown in Table 3. All variables included in the final model showed little correlation with the highest Pearson correlation coefficient being $r < 0.13$. We found blacks were more likely to receive gastrostomy in the context of an emergent admission compared to whites (AOR 1.84, CI 1.2–2.8, $p=0.005$). Women were less likely to undergo unplanned gastrostomy placement compared to men (AOR 0.77, CI 0.62–0.96, $p=0.02$). Compared to those with private insurance, Medicaid or Medicare patients were significantly more likely to undergo gastrostomy in an emergent context (AOR 4.3, AOR 1.46, $p < 0.001$, $p=0.01$ respectively). Gastrostomies performed at academic institutions were less likely to be emergent (AOR 0.49, CI 0.39–0.62, $p < 0.001$). Introduction of BIPA legislation was associated with decreased odds of emergent gastrostomy placement (AOR 0.7, CI, 0.6–0.9, $p=0.002$).

Discussion

Given the relatively predictable nature of clinical decline in ALS/MND, patients should have the opportunity for timely decision-making. Unfortunately, our results demonstrate that despite increased availability of multidisciplinary specialized care, nearly 1/3 of gastrostomies and 2/3 of tracheostomies for ALS/MND patients were placed in the context of emergent admissions.

Emergent admissions involving gastrostomy have both clinical and financial ramifications for patients and families. Patients had longer lengths of stay, higher in-house mortality, and significantly more expensive hospitalizations compared to patients undergoing these procedures non-emergently. As many terminally ill patients prefer to avoid emergent or prolonged hospitalizations, report higher quality of life at home and express a desire to avoid dying in the hospital,(10) (11, 12) longer hospitalizations may deprive patients of quality of life and increase their chances of dying away from home.

A recent Cochrane review concluded although gastrostomy insertion may extend survival in ALS, no clear evidence suggests it improves quality of life.(13) However, higher quality of life is doubtful if gastrostomies are placed during emergent or prolonged hospitalizations, particularly if outcomes are poor. In fact, previous investigations may have failed to detect improvements to quality of life if emergent and elective procedures were not distinguished. Future evaluations should differentiate between the two.

Certain patients had significantly increased likelihoods of undergoing unplanned gastrostomy. Even after adjusting for insurance, proximity to care, co-morbidities and income, blacks were nearly twice as likely to receive gastrostomy during emergent admission compared to whites. As we lack information on patients declining gastrostomy, we cannot calculate overall rates of placement. Nevertheless, it is concerning that black patients who do receive gastrostomy have significantly higher odds of undergoing an unplanned emergency admission. This may reflect fewer or lower quality end of life discussions known to occur for black patients.(14) (15)

However, the strongest association was found for Medicaid patients, who were 4.3 times more likely to undergo gastrostomy insertion emergently compared to privately insured patients, a finding which suggests the seminal role of access to care. Furthermore, emergent admissions for Medicaid patients receiving gastrostomy were more than double the cost of emergent Medicare or private insurance admissions, demonstrating that unplanned hospitalizations in this population are particularly costly.

Over the study period, the number of specialized multidisciplinary ALS clinics in Pennsylvania increased from 3 to 8. We had hypothesized that increased availability to ALS expertise might facilitate timely decision-making and decrease emergency admissions.(4) Although the overall proportion of emergent admissions did decline, in our model, proximity to an ALS center (living < 30 miles away) was associated with increased rates of emergent gastrostomy placement, even after adjusting for covariates including urban/rural status. This finding requires significant qualification: our ability to capture effects of these clinics was significantly limited by lack of information regarding where patients received outpatient care. Furthermore, although each clinic could potentially exert a different effect (significant variation in gastrostomy use has been reported(16)), we were unable to distinguish between them in our analysis. Nevertheless, this finding may suggest that patients traveling longer distances for care (such as rural patients) are accustomed to giving greater forethought to their care, perhaps because of the perception (potentially warranted) that emergent care is less accessible. Alternatively, specialty clinics may improve awareness around gastrostomy, but fail to facilitate timely placement, resulting in more emergent gastrostomies. In contrast, hospital academic affiliation was associated with significant reductions in the risk of unplanned emergent gastrostomy and tracheostomy. Academic practitioners, regardless of association with multidisciplinary clinic, may be more aware of current guidelines or more comfortable broaching end of life conversations. Future investigations incorporating location and frequency of outpatient care will offer a more accurate characterization of the impact of multidisciplinary clinics.

After implementation of BIPA in 2001, we found gastrostomy use among newly eligible patients significantly increased, in contrast to older patients for whom gastrostomy use declined. Furthermore, the proportion of emergent gastrostomies among newly eligible patients fell, suggesting BIPA not only improved access to gastrostomy, but also forestalled unplanned emergent procedures, perhaps through earlier access to care. Interestingly, the proportion of emergent gastrostomies also fell among patients >65, for whom this legislation had no effect. However, because annual gastrostomies for older patients actually fell over time, this decreased proportion in emergent procedures was due to a disproportionate drop in emergent compared to non-emergent gastrostomy. New practice guidelines addressing the timing of gastrostomy insertion released in mid-1999 may have played a role in this observed shift.(17) (18) However, because the declining trajectory precedes this, beginning after 1996, this explanation alone is inadequate (Supplemental Figure 2). This trend may indicate progress towards earlier discussions allowing older ALS/MND patients to decide either to undergo planned gastrostomy or forgo it altogether. Although our data captured all patients hospitalized or undergoing a procedure at an ambulatory surgical center, the generalizability of our findings is limited by lack of information about ALS/MND patients cared for exclusively in the outpatient setting who declined gastrostomy and tracheostomy. However, hospital administrative data has been demonstrated to have excellent sensitivity in capturing ALS/MND patients undergoing PEG and tracheostomy in a European health care system.(19) We recognize that our data contained no information regarding patient-provider discussions. Providers may initiate these discussions, but if patients are reluctant to decide, procedures may still occur emergently. Some evidence suggests that compared to patients favorably disposed towards gastrostomy or tracheostomy, undecided patients may undergo placement significantly later.(20)

Certainly, patients with faster disease progression, bulbar or respiratory onset or rapid weight loss (information our data did not contain) are likely at increased risk for emergent procedures. Furthermore, a notable subset of ALS/MND patients manifest some degree of cognitive dysfunction, often with impairments in executive or behavioral function.(21, 22) These patients may be less compliant with recommendations for gastrostomy placement and respiratory support, potentially increasing their risk for emergent gastrostomy or tracheostomy placement.(21) Nevertheless, our results suggest some patients may not be receiving the coordinated care they could get.

Future directions

As we seek to improve end-of-life care for ALS/MND and all patients with terminal illness, our findings suggest potential next steps. First, we found elective gastrostomy placement in outpatient settings increased to account for one-third of all gastrostomies placed by 2009 and can be safe and significantly less expensive. Second, our results suggest that black, male and Medicaid patients may be particularly vulnerable to delays in care leading to emergent procedures. Clinicians should recognize additional effort may be required to facilitate and inform timely decisions with these patients.

Robust, clinically meaningful methods to measure quality are essential as we seek to improve end-of-life care. As non-emergent placement for gastrostomy can provide better

outcomes, lower costs and perhaps improve quality of life for dying patients, measuring rates of non-emergent placement might provide a useful metric for measuring quality. Finally, fiscal concerns have led many states to propose significant cuts to Medicaid. However, the impact of BIPA offers evidence that policies broadening access to care at earlier stages can, for procedures like gastrostomy, improve quality by preventing unplanned emergent hospitalizations and decreasing costs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Type of admissions for all hospitalizations, gastrostomies and tracheostomies

Figure 2.

Increased annual gastrostomies performed for newly eligible Patients (Medicare, Age <65) compared to unaffected patients (Medicare, Age >65)

Table 1

Demographics and Clinical Characteristics of Patients undergoing Gastrostomy and Tracheotomy

	Gastrostomies (n = 1748)		Tracheostomies (n = 373)	
	N	%	N	%
Age (mean, SD)	66.4 ± 13.1		61.2 ± 13.1	
Sex				
Male	875	50.1%	223	59.8%
Female	873	49.9%	150	40.2%
Race				
White	1419	81.2%	288	77.2%
Black	125	7.2%	52	13.9%
Other	204	11.7%	33	8.9%
Ethnicity				
Hispanic	24	1.4%	4	1.1%
Non-Hispanic	1723	98.6%	377	99%
Urban/Rural Status				
Rural	308	17.8%	58	15.6%
Urban	1420	81.2%	313	84.4%
Median Income				
<30,000	244	14.0%	66	17.7%
30–40K	576	33.0%	127	34.1%
40–60K	589	33.7%	121	32.4%
60–80	252	14.4%	42	11.3%
80	87	5.0%	17	4.6%
Insurance Payer				
Private	563	32.2%	151	39.4%
Medicaid	61	3.5%	26	7.0%
Medicare	1078	61.7%	193	51.7%
Other	33	1.9%	5	1.3%
Uninsured	13	0.7%	2	0.5%
Distance to center, miles (mean, SD)	33.5 ± 70.7		34.2 ± 118	
< 30 miles	1077	61.6%	245	65.7%
30 miles	671	38.4%	128	34.3%
Hospital Size				
Small (< 100 beds)	58	3.3%	8	2.1%
Medium (101–250 beds)	372	21.3%	83	22.3%
Large (>250 beds)	1318	75.4%	282	75.6%
Hospital affiliation				
Academic	1205	68.9%	263	70.5%
Non-academic	543	31.1%	110	29.5%

	Gastrostomies (n = 1748)		Tracheostomies (n = 373)	
	N	%	N	%
Inpatient vs. Outpatient				
Inpatient	1331	76.1%	373	100%
Ambulatory Surgical Center	417	23.9%	0	0%
Length of stay, days (mean, SD)	7.9 ± 12.7		26.7 ± 21.2	
Discharge Disposition				
In-house mortality	64	3.7%	34	9%
Routine / Home with services	1166	66.8%	96	25.8%
Hospice	25	1.4%	6	1.6%
LTAC	35	2.0%	65	17.5%
Total Charges (mean, SD)	\$ 44,685 ± 105,255	Median \$ 12,595	\$ 213,807 ± 251,392	Median \$ 128,665

Table 2
Comparative demographics and outcomes for emergent (versus non-emergent) hospitalizations involving gastrostomy and tracheostomy

	Gastrostomies (n = 1748)			Tracheostomies (n = 373)		
	Emergent (n=554)	%	p value	Emergent (n=248)	%	p value
Age (years, SD)	69.3 ± 13.2	65.1 ± 12.9	<0.001	61.8 ± 12.9	60 ± 13.4	0.2
Sex			0.3			0.02
Male	287	32.8 %		138	61.8 %	
Female	267	30.6 %		110	73.3 %	
Race			<0.001			0.5
White	449	31.6 %		189	65.6 %	
Black	65	52.0 %		38	73.1 %	
Other	40	19.6 %		21	63.6 %	
Ethnicity			0.5			
Hispanic	9	37.5 %		3	75 %	0.7
Urban/Rural Status			0.001			0.02
Rural	74	24.0 %		31	53.5 %	
Urban	472	33.2 %		216	69.0 %	
Median Income			<0.001			0.6
<30,000	115	47.1 %		46	69.7 %	
30–40K	193	33.5 %		87	68 %	
40–60K	158	26.8 %		74	61.6 %	
60–80	61	24.2 %		28	66.7 %	
>80	27	31.0 %		13	76.5 %	
Insurance Payer			<0.001			0.02
Private	119	21.1 %		83	56.5 %	
Medicaid	35	57.4 %		19	73.1 %	
Medicare	387	35.9 %		141	73.1 %	
Other	8	24.4 %		4	80 %	
Uninsured	5	38.5 %		1	50 %	
Distance to center			<0.001			0.16

	Gastrostomies (n = 1748)		p value	Tracheostomies (n = 373)		p value
	Emergent (n=554)	%		Emergent (n=248)	%	
< 30 miles	375	34.8 %		169	69.0 %	
30 miles	179	26.7 %		79	61.7 %	
Hospital Size						0.003
Small	14	24.1 %	<0.001	5	62.5 %	
Medium	152	40.9 %		68	81.9 %	
Large	388	29.4 %		175	62.3 %	
Academic affiliation						<0.001
Academic	318	26.4 %	<0.001	160	60.8 %	
Non-academic	236	43.5 %		88	80.0 %	
Inpt vs. Outpt						
Inpt	554	41.6 %	<0.001	248	66.5 %	
Outpt	0	0 %		0	0 %	
Length of Stay (days, SD)	14.8 ± 15.5	4.7 ± 9.7	<0.001	25.7 ± 18	28.8 ± 26	0.2
Disposition						0.4
In-house mortality	41	64.1 %		25	73.5 %	
Routine/Home w/services	208	17.8 %		57	59.4 %	
Hospice	12	48 %		5	83.3 %	
LTAC	24	70.6 %		46	70.8 %	
Cost (mean, SD)	\$82,875 ± 133,643	\$26,965 ± 83,383	<0.001	\$ 197,271 ± 211,813	\$246,614 ± \$313,997	0.07

* Values may not sum to 100% due to rounding

† Categorical values were analyzed using the χ^2 test and continuous values were analyzed using the t-test

†† For continuous values, the mean and standard deviation for non-emergent admissions is presented in the column to the right

Table 3

Predictors of Gastrostomy, Tracheostomy insertion during emergent admission

Gastrostomy			
Characteristics	Adjusted OR	95% CI	P value
Age	1.02	(1.01–1.03)	<0.001
Sex (Female)	0.77	(0.62–0.96)	0.021
Morbid	1.06	(0.95–1.17)	0.29
Race (ref= white)			
Black	1.84	(1.2–2.8)	0.005
Other	0.49	(0.34–0.74)	<0.001
Urban residence	1.37	(0.99–1.9)	0.05
Insurance (ref= private)			
Medicaid	4.30	(2.4–7.8)	<0.001
Medicare	1.46	(1.1–1.9)	0.01
Academic	0.49	(0.39–0.62)	<0.001
After BIPA implementation	0.70	(0.56–0.88)	0.002
Close to center	1.71	(1.31–2.21)	<0.001

Tracheostomy*			
Characteristics	Adjusted OR	95% CI	P value
Academic	0.37	(0.21–0.65)	<0.001
Urban residence	2.18	(1.17–4.05)	0.01
Insurance (ref=private)			
Medicaid	2.14	(0.8–5.7)	0.18
Medicare	1.95	(1.1–3.4)	0.02

* Adjusted for age, sex, income and co-morbidities