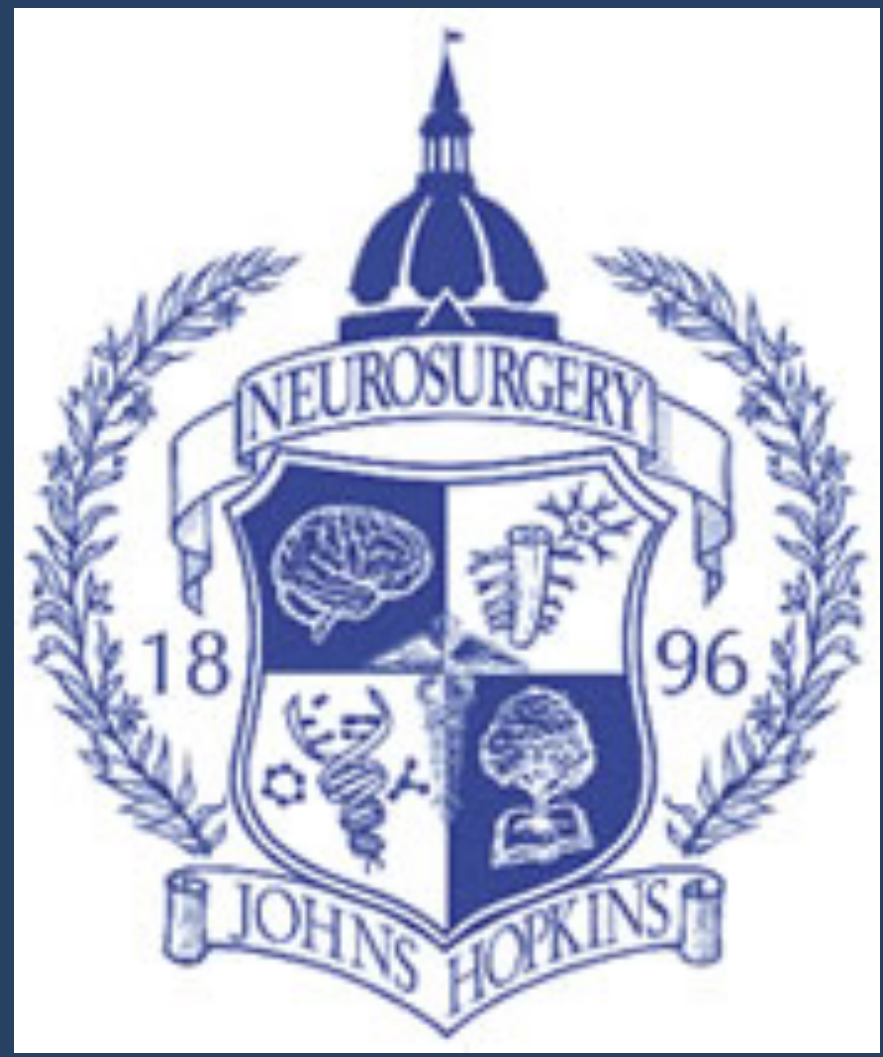


# The role of frailty in predicting postoperative socioeconomic outcomes among patients with metastatic brain tumors

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## Introduction

- Patient frailty has been shown to effectively predict postoperative morbidity and mortality in many surgical subspecialties.
- However, for metastatic brain tumor patients, it is unclear whether frailty effectively predicts meaningful postoperative outcomes, such as hospital length of stay (LOS).

## Objective

We sought to determine if the 5-factor modified frailty index (mFI-5) independently predicts LOS, discharge disposition, and total hospital charges among patients with metastatic brain tumors.

**Table 1:** Patient demographics and clinical characteristics for overall cohort (n=302)

Characteristic	n (%)
Mean age in years (± SD)	62.27 ± 11.86
Sex	
Female	157 (52.0)
Male	145 (48.0)
Race	
Caucasian	224 (74.2)
African-American	56 (18.5)
Asian	13 (4.3)
Other	9 (3.0)
Ethnicity	
Hispanic/Latino	8 (2.6)
Not Hispanic/Latino	294 (97.4)
Marital Status	
Married	182 (60.3)
Not Married	120 (39.7)
Insurance	
Private	145 (48.0)
Medicare	127 (42.1)
Medicaid	25 (8.3)
Admission Source	
Home	214 (70.9)
Non-home	88 (29.1)
Primary cancer type	
Lung	75 (24.8)
Breast	41 (13.6)
Skin	38 (12.6)
Adenocarcinoma of unknown primary site	32 (10.6)
Gastrointestinal	31 (10.3)
Other unknown site	33 (10.9)
Other specific site	24 (7.9)
Renal	12 (4.0)
Small cell carcinoma of unknown primary site	9 (3.0)
Squamous cell carcinoma of unknown primary site	7 (2.3)
Known primary site metastases	
Yes	221 (73.2)
No	81 (26.2)
Mean mFI-5 (± SD)	0.97 ± 0.90
Medical comorbidities comprising the mFI-5	
Hypertension	163 (54.0)
Diabetes	48 (15.9)
Heart Failure	14 (4.6)
Chronic obstructive pulmonary disease	46 (15.2)
Functional Status	21 (7.0)
Mean surgery duration in minutes (± SD)†	145.78 ± 79.02
Mean length of stay (± SD)	6.46 ± 6.47
Discharge disposition	
Routine	232 (76.2)
Non-routine	70 (23.2)
Mean total hospital charges (± SD; \$)	41,214.95 ± 23,415.48

†One patient excluded due to lack of information on surgery duration. mFI-5: 5-factor modified frailty index; SD: standard deviation. Other specific metastasis sites: 5 of female reproductive organ origin, 4 large neuroendocrine carcinomas, 4 of prostate origin, 3 of thyroid origin, 2 of parotid gland origin, 1 of bladder origin, 1 of urothelial origin, 1 of vascular origin, 1 of olfactory neuroepithelial origin, 1 seminoma.

**Table 2:** Clinical characteristics for patient cohorts with known (n=221) and unknown primary site (n=81) metastases

Characteristic	Known primary site metastases, n (%)	Unknown primary site metastases, n (%)	p-value
Admission Source			
Home	156 (70.6)	58 (71.6)	0.89
Non-home	65 (29.4)	23 (28.4)	
Mean mFI-5 (± SD)	0.95 ± 0.93	1.00 ± 0.81	0.43
Medical comorbidities comprising the mFI-5			
Hypertension	115 (51.8)	48 (60.0)	0.61
Diabetes	33 (14.9)	15 (18.8)	–
Heart Failure	10 (4.5)	4 (5.0)	–
Chronic obstructive pulmonary disease	35 (15.8)	11 (13.8)	–
Functional Status	18 (8.1)	3 (3.8)	–
Mean surgery duration in minutes (± SD)†	149.20 ± 85.20	136.49 ± 58.55	0.32
Mean length of stay (± SD)	6.36 ± 5.72	6.74 ± 8.20	0.66
Discharge disposition			
Routine	169 (76.5)	63 (77.8)	0.88
Non-routine	52 (23.5)	18 (22.2)	
Mean total hospital charges (± SD; \$)	41,262.20 ± 21,818.16	41,086.01 ± 27,455.60	0.60

†One patient excluded due to lack of information on surgery duration. mFI-5: 5-factor modified frailty index; SD: standard deviation.

**Table 3:** Patient characteristics significantly associated with socioeconomic outcomes in bivariate analysis (n=302)

Variable	Socioeconomic outcomes						
	Length of stay in days		Discharge Disposition			Total hospital charges (\$)	
	Mean (± SD)	p-value	Routine, n (%)	Non-routine, n (%)	p-value	Mean (± SD)	p-value
Mean age (± SD)	–	0.11	60.59 ± 11.67	67.82 ± 10.78	< 0.0001*	–	0.53
Race							
Caucasian	5.65 ± 4.77	<b>0.0092*</b>	179 (52.3)	45 (14.9)	Ref	38,252.59 ± 19,151.50	< 0.0001*
African-American	10.06 ± 10.56	–	36 (11.9)	20 (6.62)	<b>0.020*</b>	54,108.62 ± 33,563.35	–
Asian	5.33 ± 3.69	–	9 (3.0)	4 (1.3)	0.48	37,846.54 ± 17,375.60	–
Other	6.02 ± 6.33	–	8 (2.6)	1 (0.3)	1.00	39,582.87 ± 27,781.2	–
Admission source							
Home	4.82 ± 4.40	< 0.0001	179 (59.3)	35 (11.6)	< 0.0001	35,695.79 ± 17,784.71	< 0.0001
Non-home	10.45 ± 8.63	–	53 (17.5)	35 (11.6)	–	54,636.53 ± 29,418.07	–
Mean mFI-5	–	< 0.0001	0.83 ± 0.82	1.43 ± 0.99	< 0.0001	–	< 0.001
Surgery duration†	–	0.10	144.70 ± 81.50	149.42 ± 70.48	0.48	–	< 0.0001

†One patient excluded due to lack of information on surgery duration. Ref: reference group.

**Table 4:** Multivariate analysis of socioeconomic outcomes (n=302)

Variable	Multivariate regression models								
	Length of stay			Nonroutine discharge disposition			Total hospital charges†		
	Coefficient	p-value	95% CI	Odds Ratio	p-value	95% CI	Coefficient	p-value	95% CI
Age	–	–	–	1.06	< 0.001	1.03 – 1.10	–	–	–
Race									
Caucasian	Ref	–	–	Ref	–	–	Ref	–	–
African-American	4.17	< 0.0001	2.52 – 5.82	2.98	<b>0.0037</b>	1.42 – 6.26	14,137.46	< 0.0001	8257.80 – 20,017.13
Asian	0.10	0.95	-3.04 – 3.25	3.16	0.095	0.75 – 11.88	-1413.87	0.80	-12,630.03 – 9802.29
Other	2.55	0.19	-1.25 – 6.36	1.28	0.85	0.054 – 11.13	3373.75	0.63	-10,260.63 – 17,008.13
Admission source									
Home	Ref	–	–	Ref	–	–	Ref	–	–
Non-home	5.39	< 0.0001	3.99 – 6.80	3.63	< 0.0001	1.96 – 6.80	16,828.16	< 0.0001	11,803.93 – 21,852.39
mFI-5	1.36	< 0.001	0.64 – 2.08	1.60	<b>0.0079</b>	1.14 – 2.29	4325.54	<b>0.0010</b>	1757.89 – 6893.20
Surgery duration	–	–	–	–	–	–	78.76	< 0.0001	49.60 – 107.92

†One patient excluded due to lack of information on surgery duration. Ref: reference group.

## Methods

- A total of 302 patients undergoing surgery for metastatic brain tumors between 2017-2019 at a single academic institution were analyzed.
- Multivariate linear regression was used to identify independent predictors of LOS and total hospital charges.
- Multivariate logistic regression was used to identify independent predictors of non-routine discharge disposition.

## Results

- Each one point increase in mFI-5 score independently predicted longer LOS (regression coefficient [Coef]=1.36 days, p<0.001), non-routine discharge disposition (odds ratio [OR]=1.60, p=0.0079), and higher total hospital charges (Coef=\$4325.54, p=0.0010).

## Discussion

- There was a significant predictive ability of the mFI-5 index to predict post-operative socioeconomic outcomes among metastatic brain tumor patients.
- Compared to other indices whose multivariate factors may be more difficult for clinicians to obtain efficiently and accurately, the mFI-5 has potential to be commonly utilized in preoperative evaluations for patients with brain tumors due to its relative simplicity and predictive strength.

## Conclusion

- The mFI-5 independently predicts LOS, discharge disposition, and total hospital charges among our cohort of metastatic brain tumor patients.
- Our findings may be useful in optimizing operative and hospital resource allocation.