

# Analysis of Echocardiogram Findings in Stroke and TIA Patients

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## Background

According to the American Heart Association, performing a transthoracic echocardiogram (TTE) in every confirmed stroke and transient ischemic attack (TIA) is a class 2a recommendation and a transesophageal echocardiogram TEE is a class 2b recommendation [1]. Multiple cardiac sources exist for strokes; valvular vegetations, PFOs and several other etiologies. Echocardiography may rule out cardiac causes or reveal actionable information; however, previous research questions the efficacy of performing echocardiography in an inpatient setting since these smaller studies have shown the vast majority of echocardiograms do not yield actionable results [2]. These findings are even more relevant when the patient has multiple risk factors that are more likely to be the cause of the stroke than a cardio embolic cause. In addition, previous research suggests that the need for TEEs to find Patent Foramen Ovaeles (PFOs) might be unwarranted in patients with risk factors that are more likely to explain their stroke [3].

This study evaluated the frequency of echocardiography in our patient population and the timeline in which subsequent procedures are performed. We plan to provide recommendations to guide current policies in an effort to shorten a patient's hospital stay, lessen complications from invasive diagnostic procedures, decreasing their frequency, or moving these procedures to the outpatient setting.

## Objective

This study intends to determine the utility of in patient echocardiography in stroke patients. Specifically by examining the number of echocardiograms, the number and types of findings and the number of subsequent interventions.

We planned to analyze by negative binomial regression the length of stay and the kind of echo received. Additionally we planned to correlate the relationship between the type of echo performed and mortality as well as the type of echo and ICU admissions.

## Methods

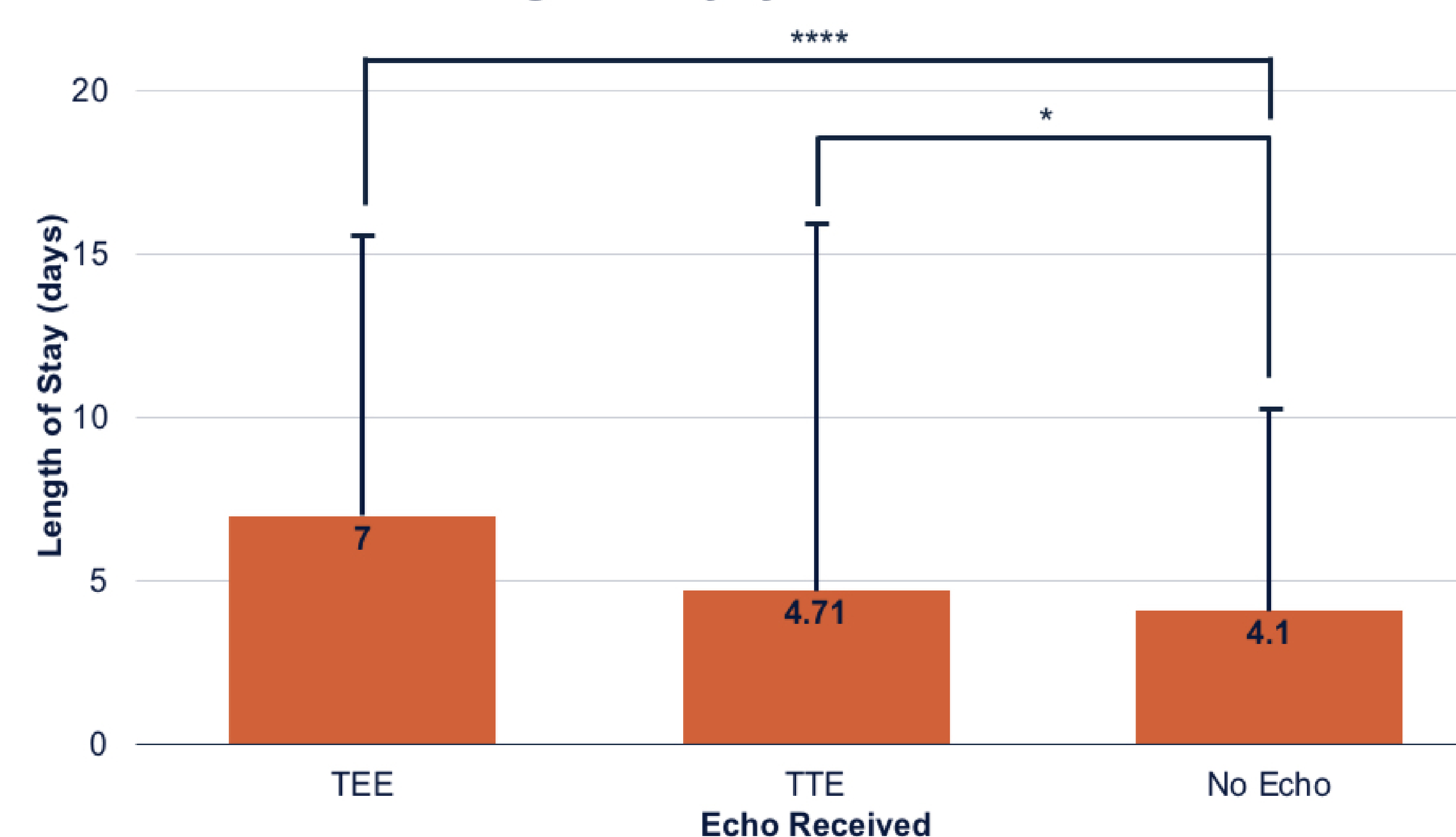
	Total	Thrombus	None
N (%)	49,216 (100.00)	137 (0.28)	49,079 (99.72)
Sex (N, %)			
F	25,648 (52.11)	47 (34.31)	25,601 (52.16)
M	23,568 (47.89)	90 (65.69)	23,478 (47.84)
AFIB (N, %)			
0	39,648 (80.56)	102 (74.45)	39,546 (80.58)
1	9,568 (19.44)	35 (25.55)	9,533 (19.42)
Smoking (N, %)			
Unknown	4,791 (9.73)	16 (11.68)	4,775 (9.73)
Never	23,126 (46.99)	51 (37.23)	23,075 (47.02)
Former	11,860 (24.10)	26 (18.98)	11,834 (24.11)
Current	9,439 (19.18)	44 (32.12)	9,395 (19.14)
Age (M, SD)	68.64 (13.88)	63.26 (13.47)	68.65 (13.88)
Elixhauser (M, SD)	4.79 (2.17)	5.99 (2.18)	4.78 (2.17)
Min Glasgow (N, M, SD)	11,363 13.67 (2.64)	85 13.19 (2.67)	11,278 13.68 (2.64)
Avg Glasgow (N, M, SD)	11,363 14.32 (1.68)	85 14.24 (1.51)	11,278 14.32 (1.68)

Demographics by Finding

This is a retrospective study within a large hospital system in Florida. Thirteen hospitals were included, three of which are stroke centers. We used ICD-10 codes to include any diagnosis that would lead the patient to be worked up as a potential stroke. We excluded any patient that had an ICD-10 code associated with a hemorrhagic stroke. A total of 49,216 patients met the criteria. We tracked how many had echocardiogram and whether they were TEEs or TTEs. We then used ICD-10 codes to see if a diagnosis had changed to include a PFO or Intracardiac thrombi. We also used CPT codes to see if any relevant procedures had been performed during their hospitalization. We recorded length of hospital stay and then compared those who had echocardiograms and those that did not.

## Results

Length of Stay by Echo Received



\*\*\*\* p < 0.0001  
\* p < 0.05

Receiving a TTE increased the count of days by a factor of 1.028 compared to not receiving an echo at all (p < 0.05, 95% CI [1.004, 1.053]).

Receiving TEE increased the count of days by a factor of 1.635 compared to not receiving an echo at all (p < 0.0001, 95% CI [1.560, 1.713])

### Results

0

Zero PFOs found

71

71 Intracardiac thrombi found

0

Zero Interventions performed

## Discussion

Many interesting points were found during this retrospective study. The most surprising of which was that not a single PFO was found. 71 intracardiac thrombi were found but no intervention was performed during their hospital stay. Their length of stay was also found to have significantly increased with an echocardiogram. The average length of stay was 4.11 days for patients who received no echocardiogram. For patients who had a TTE it was 4.71 and for patients who received a TEE it was 7.01.

Additionally it was found that a TEE correlated with a lower level of mortality and a higher rate of ICU admissions. This could be because TEEs were done in patient's who were under closer observation. However their general level of illness was corrected for by the Elixhauser Index.

Our results suggest that echocardiography to evaluate the etiology of a stroke is not a necessary in-patient test. This is because the probability of finding intracardiac pathology is low and only a small percentage of those pathologies found would have interventions performed. The increased length of stay and potential complications that a patient is subjected to does not support the frequent use of echocardiography. Whether or not a patient requires an echocardiogram after a stroke is a clinical decision and should be made based on the patient's risk factors since those are what would determine an intervention. However the decision to do so in an inpatient setting should be weighed against the possibility of performing it in an outpatient setting. It should not be one made reflexively simply because a patient presented with stroke like symptoms or even if they had a confirmed ischemic stroke.

## Conclusion

- Echocardiograms in this population are likely to be unremarkable
- If thrombi are found, they are likely to not be worth intervening upon
- Echocardiograms, especially TTEs significantly increase a patient's length of stay

## References

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# Tables

**Mortality and Type of Echo**

Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	95% CI	
							Odds Ratio	Lower
Intercept		1	-8.7757	0.1979	1966.6798	<.0001		
ECHO	TEE	1	-0.6134	0.1866	10.8096	0.0010	0.541	0.376 0.781
ECHO	TTE	1	0.1361	0.0594	5.2599	0.0218	1.146	1.020 1.287
AGE		1	0.0501	0.00233	461.5636	<.0001	1.051	1.047 1.056
SEX	M	1	0.0269	0.0477	0.3164	0.5738	1.027	0.935 1.128
AFIB	1	1	0.4520	0.0497	82.8342	<.0001	1.571	1.426 1.732
ELIX		1	0.2808	0.00992	800.7532	<.0001	1.324	1.299 1.350
SMOKING_STAT	0	1	1.3934	0.0577	583.3125	<.0001	4.028	3.598 4.511
SMOKING_STAT	2	1	0.0337	0.0627	0.2888	0.5910	1.034	0.915 1.170
SMOKING_STAT	3	1	0.1927	0.0848	5.1622	0.0231	1.212	1.027 1.432

• Interpretation – Mortality was decreased with a TEE

**ICU Admission and Type of Echo**

Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	95% CI	
							Odds Ratio	Lower
Intercept		1	-2.5105	0.0759	1093.2651	<.0001		
ECHO	TEE	1	0.7744	0.0585	175.3759	<.0001	2.169	1.934 2.433
ECHO	TTE	1	0.6111	0.0308	393.9153	<.0001	1.842	1.735 1.957
AGE		1	-0.00636	0.000997	40.7443	<.0001	0.994	0.992 0.996
SEX	M	1	0.1035	0.0253	16.7478	<.0001	1.109	1.055 1.165
AFIB	1	1	0.4480	0.0301	221.8237	<.0001	1.565	1.476 1.660
ELIX		1	0.1772	0.00563	988.5165	<.0001	1.194	1.181 1.207
SMOKING_STAT	0	1	0.6726	0.0391	295.9323	<.0001	1.959	1.815 2.115
SMOKING_STAT	2	1	0.0609	0.0323	3.5544	0.0594	1.063	0.998 1.132
SMOKING_STAT	3	1	0.2303	0.0351	43.1600	<.0001	1.259	1.175 1.349

• Interpretation – ICU admissions were increased with any echo, especially a TEE

**Length of Stay and Type of Echo**

Parameter		DF	IRR	Standard Error	IRR 95% CI		Wald $\chi^2$	Pr > ChiSq
					Lower	Upper		
Intercept		1	1.107051	0.0278	1.048332	1.16906	13.36	0.0003
ECHO	TEE	1	1.634767	0.0239	1.559866	1.713435	421.46	<.0001
ECHO	TTE	1	1.028293	0.0124	1.003707	1.053481	5.1	0.024
AGE		1	1.0008	0.0004	1.0001	1.001501	4.8	0.0285
SEX	M	1	1.126821	0.0091	1.10683	1.147172	171.48	<.0001
AFIB	1	1	1.152692	0.0115	1.126933	1.179039	151.83	<.0001
ELIX		1	1.251572	0.0022	1.246077	1.257091	10053.7	<.0001
SMOKING_STAT	0	1	1.005817	0.0157	0.97531	1.037174	0.14	0.7123
SMOKING_STAT	2	1	1	0.0113	0.978045	1.022448	0	0.9997
SMOKING_STAT	3	1	1.0006	0.0127	0.975993	1.02593	0	0.9599
Dispersion		1	2.035009	0.0061	2.011137	2.059576		

• Interpretation – Echos significantly increased length of stay

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