

Stroke thrombectomy volume, rather than stroke center accreditation status of hospitals, is associated with mortality and discharge disposition

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ABSTRACT

Background Few studies have explored the association between stroke thrombectomy (ST) volume and hospital accreditation with clinical outcomes.

Objective To assess the association of ST case volume and accreditation status with in-hospital mortality and home discharge disposition using the national Medicare Provider Analysis and Review (MEDPAR) database.

Methods Rates of hospital mortality, home discharge disposition, and hospital stay were compared between accredited and non-accredited hospitals using 2017–2018 MEDPAR data. The association of annual ST case volume with mortality and home disposition was determined using Pearson's correlation. Median rate of mortality and number of ST cases at hospitals within the central quartiles were estimated.

Results A total of 29 355 cases were performed over 2 years at 847 US centers. Of these, 354 were accredited. There were no significant differences between accredited and non-accredited centers for hospital mortality (14.8% vs 14.5%, $p=0.34$) and home discharge (12.1% vs 12.0%, $p=0.78$). A significant positive correlation was observed between thrombectomy volume and home discharge ($r=0.88$; 95% CI 0.58 to 0.97, $p=0.001$). A significant negative relationship was found between thrombectomy volume and mortality ($r=-0.86$; 95% CI -0.97 to -0.49 , $p=0.002$). Within the central quartiles, the median number of ST cases at hospitals with mortality was 24/year, and the median number of ST cases at hospitals with home discharge rate was 23/year.

Conclusion A higher volume of ST cases was associated with lower mortality and higher home discharge rate. No significant differences in mortality and discharge disposition were found between accredited and non-accredited hospitals.

timely and universal. Aldstadt *et al* reported that access to endovascular care at thrombectomy-capable centers (TCCs) or comprehensive stroke centers (CSCs) is only available to 49.6% residents by ground and 64.8% via both ground and air.⁴ Although a need for more endovascular-capable centers (ECCs) is intuitive, concerns exist about the volume of cases necessary to establish and maintain an ECC while ensuring competency of the interventionists.

The distribution of ECCs in the USA is non-uniform.⁵ Several large metropolitan areas are saturated with ECCs, competing for stroke cases within the same catchment areas.⁴ By contrast, the operators at some ECCs are responsible for covering vast geographic areas in the states where only a few centers may be available to provide stroke care for a much larger population.⁴ Therefore, the annual number of stroke thrombectomy (ST) cases required to maintain competency at individual and institutional levels has been hotly debated.^{6,7} Unfortunately, only a few studies have looked at the association of case volume with clinical outcomes and these indicate a positive association between the two variables.^{8,9} Available recommendations on the minimum case volume required for accreditation and to maintain individual competency are based on consensus statements issued by several neuro-interventional organizations.^{3,6,7} The accreditation and certification criteria differ between accreditation agencies, with different requirements for the specific number of cases needed for institutional and individual accreditation.¹⁰ These accreditation standards were derived through consensus between experts in the field. For example, the Joint Commission formulated a technical advisory panel on certification of stroke centers, which consisted of experts from multiple disciplines. The panel held discussions with various stakeholders and recommended an individual volume of 15 cases per year with a hospital volume of 25–30 cases per year.¹¹ This recommendation was endorsed by the Society of NeuroInterventional Surgery (SNIS), Society of Vascular and Interventional Neurology, American Association of Neurological Surgeons, and the Congress of Neurological Surgeons.¹² There has

BACKGROUND

The stroke systems of care are continuously evolving. Large vessel occlusion ischemic stroke carries higher morbidity and mortality than small vessel stroke.¹ Provision of endovascular treatment for large vessel occlusion stroke has become central to the organization of stroke systems of care.^{1–3} As a principle, access to endovascular care should be



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been criticism of these numbers.¹³ Fargen *et al* argued that these numbers are too low to maintain competency, especially because each center is likely to have two to three neurointerventionists, meaning that each operator will have performed only five cases per year or up to 10 in 2 years.¹³ Nevertheless, leading experts in the field have repeatedly supported the above numbers.^{7,12} In this context, more data on the association of ST volume and clinical outcomes would be critical to help formulate evidence-based recommendations. In the presence of limited data, consensus among field experts on an optimal case volume may be the best approach, yet the data on the association of ST volume and clinical outcomes remains vitally important.

Few studies have explored the impact of accreditation with the current volume requirement on the clinical outcomes at ECCs. In this study, we explored the association of ST volume and accreditation status with mortality, discharge disposition, and in-hospital length of stay using nationwide Medicare Provider Analysis and Review (MEDPAR) data (<https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/MedicareFeeForSvcPartsAB/MEDPAR>). Further, we estimated the number of annual ST cases associated with optimal clinical outcomes with a rationale to provide data to support decision-making with respect to accreditation standards and policies.

METHODS

We analyzed the hospital-based Centers for Medicare and Medicaid Services (CMS) MEDPAR data from 2017 and 2018. Permission for analysis was obtained from the CMS. Endovascular mechanical thrombectomy (MT) cases were identified using the International Classification of Disease 10th revision (ICD-10) codes 03CG3Z7, 03CK3Z7, 03CL3Z7, 03CP3Z7, 03CQ3Z7, 03CG3ZZ, 03CK3ZZ, 03CL3ZZ, 03CP3ZZ, and 03CQ3ZZ. National Provider Identifiers (<https://www.cms.gov/Regulations-and-Guidance/Administrative-Simplification/NationalProvIdentStand>) were used to identify the hospitals where the procedures were performed. Lists of CSCs and TCCs were obtained from the Joint Commission (<https://www.jointcommission.org/accreditation-and-certification/certification/certifications-by-setting/hospital-certifications/stroke-certification/advanced-stroke/comprehensive-stroke-center/>), Det Norske Veritas (DNV) Healthcare (https://www.dnvglhealthcare.com/hospitals?search_type=and&q=&c=20806&c=&prSubmit=Search&page=8), Healthcare Facilities Accreditation Program (<https://www.hfap.org/search-facilities/>), and state health departments. Both CSCs and TCCs were considered endovascular-capable stroke centers. The list of stroke centers

that performed endovascular ST was cross-referenced with the list of accredited centers. Clinical outcomes of interest included mortality, discharge to home, and length of hospital stay.

The independent t-test was used to compare the mean rates of mortality, home discharge, and length of stay between accredited and non-accredited centers. Pearson's correlation was determined between institutional volume of ST cases and mortality, discharge disposition, and length of stay for 2017 and 2018 separately and for the combined 2017 and 2018 data. After removing the centers at which fewer than five cases were performed over those 2 years, we determined the IQR for mortality. The median number of cases at hospitals achieving mortality rates within that IQR was then determined.

RESULTS

A total of 29 355 procedures of ST were performed over 2 years at 847 hospitals across the USA. The number of cases increased from 12 386 in 2017 to 16 969 in 2018, an increment of 37.0%. Of the hospitals, 354 (42%) were accredited. A total of 21 319 (72.6%) procedures were performed at accredited centers (20 128 in CSCs; 1191 in TCCs), and 8036 (27.4%) were performed at non-accredited centers. There was no significant difference between the accredited and non-accredited centers in hospital mortality (14.8% vs 14.5%, $p=0.34$) and home discharge disposition (12.1% vs 12.0%, $p=0.78$). There was also no significant difference between accredited and non-accredited centers in the length of hospital stay (8.09 ± 7.2 vs 8.1 ± 8.1 , $p=0.79$). No significant difference in mortality was seen between CSCs, TCCs, and non-accredited centers (14.8% vs 13.3% vs 14.8%, respectively, $p=0.16$). The percentage of patients discharged home was significantly lower for TCCs than for CSCs and non-accredited centers (10.1% vs 12.3% vs 12.0%, respectively, $p=0.018$). However, it must be noted that procedures performed at TCCs constituted 7.2% of all cases. A significant positive correlation was observed between thrombectomy volume and percentage of patients discharged home. This trend was consistent for both 2017 and 2018 ($r=0.97$, 95% CI 0.86 to 0.99, $p<0.001$; and $r=0.89$, 95% CI 0.58 to 0.97, $p=0.001$, respectively) (figure 1A and B). The positive correlation of thrombectomy volume with home discharge for the overall 2-year (2017 and 2018) cohort was $r=0.66$ (95% CI 0.047 to 0.91, $p=0.039$) (figure 1C).

A significant inverse relationship was found between thrombectomy volume and mortality for both 2017 ($r=-0.75$; 95% CI -0.94 to 0.24 , $p=0.012$) and 2018 ($r=-0.85$, 95% CI -0.96 to -0.48 , $p=0.002$) (figure 2A and B). The negative correlation for the overall cohort (2017 and 2018) was -0.86 (-0.97 to -0.49 , $p=0.002$) (figure 2C). A statistically significant

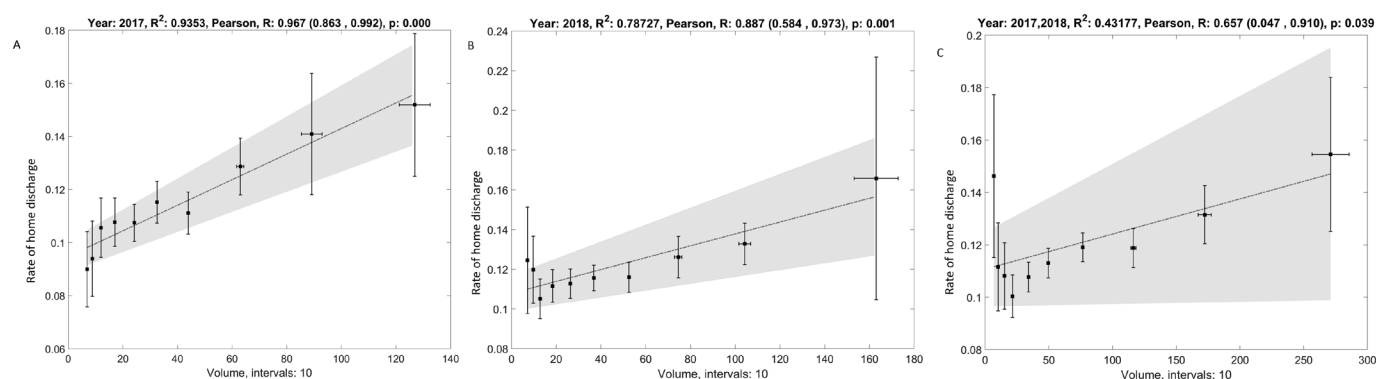


Figure 1 Graph shows a positive and significant statistical correlation between rate of home discharge (y axis) and thrombectomy volume (x axis) for the year 2017 (A). Similar relationships are shown for 2018 (B) and a combination of years 2017 and 2018 (C).

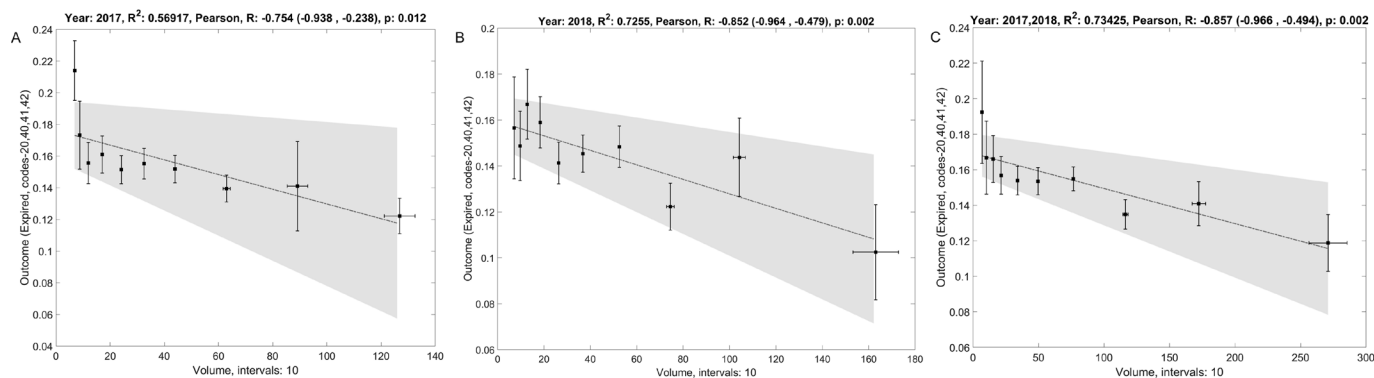


Figure 2 Graph shows a negative and significant statistical correlation between in-hospital mortality (y axis) and thrombectomy volume (x axis) for the year 2017 (A). Similar relationships are shown for year 2018 (B) and a combination of years 2017 and 2018 (C).

negative correlation was seen between volume and length of stay ($r = -0.10$, $p = 0.043$).

The median mortality was 7.8% (IQR 15.9–21.4). The median number of cases performed at hospitals with mortality rate between the first and third quartiles was 48 per 2 years (IQR 20–69) or 24 per year (IQR 10–34.5). The median rate of home discharge was 5.36% (IQR 11.1–17.6). The median number of ST cases in hospitals within the first and third quartiles was 46 per 2 years (IQR 26.24–77) or 23 per year (IQR 13.12–38.5).

DISCUSSION

We present several key statistics to guide accreditation standards for stroke systems of care in the USA. ST was performed at 847 centers, of which fewer than 50% were accredited or designated as comprehensive or thrombectomy-capable stroke centers. Interestingly however, the accredited centers were responsible for 72.4% of all MT cases in the USA.

Previous studies have shown that care in designated stroke centers results in a reduction in mortality.^{14 15} There are few data that directly compare mortality between accredited and non-accredited centers after the institution of the thrombectomy guidelines. In our study, no significant difference in mortality or discharge disposition was seen between the accredited and non-accredited centers. Hospital ST volume alone was seen to strongly correlate with mortality and discharge disposition. We saw a 37% increase in the case volume from 2017 to 2018. This is in line with previously reported estimates and could be a result of the increasing number of ST-capable sites, better organized stroke triage mechanisms, and the expansion of clinical indications in 2018 after the publication of the Defusion-weighted imaging or CT perfusion Assessment with clinical mismatch in the triage of Wake-up and late-presenting strokes undergoing Neurointervention with Trevo (DAWN) and Endovascular Therapy Following Imaging Evaluation for Ischemic Stroke (DEFUSE) three trials.^{13 16 17} In a recent analysis of Medicare data from 2016 and 2017, thrombectomy volume was found to be the most important determinant of mortality and favorable outcomes.⁹ The authors of that study found that for every 10 additional procedures, patients had 4% lower adjusted odds of inpatient mortality (adjusted OR (aOR)=0.96 (95% CI 0.95 to 0.98); $p < 0.0001$) and 3% greater adjusted odds of favorable outcome (aOR=1.03 (95% CI 1.02 to 1.04); $p < 0.0001$).⁹ Similarly, for every 10 additional hospital cases (combined cases of all the proceduralists at the hospitals), patients had 2% lower odds of inpatient mortality (aOR=0.98 (95% CI 0.98 to 0.99); $p = 0.0003$) and 2% greater odds of favorable outcome

(aOR=1.02 (95% CI 1.01 to 1.02); $p < 0.0001$).⁹ With increasing volumes, there were higher odds of favorable outcomes.⁹

A possible reason for the lack of association between accreditation and clinical outcomes is the relatively small volume of cases required to obtain accreditation. For example, the Joint Commission requires a stroke center to have performed endovascular MT on 15 patients in 1 year or 30 cases in the preceding 2 years (<https://www.jointcommission.org/-/media/tjc/documents/accred-and-cert/certification-by-setting/stroke/dsc-stroke-grid-comparison-chart.pdf>). Additionally, the Joint Commission requires an individual neurointerventionist to have performed 15 cases per year, which may be carried out at more than one hospital or health facility. Similarly, DNV requires CSCs to have performed 25 ST procedures over 2 years. A volume of 15 thrombectomies over the initial year is regarded as adequate by DNV. There has been criticism of these numbers.¹³ Fargen *et al* argued that this number is too low to maintain competency, especially as each center is likely to have two or three neurointerventionists, meaning that each operator will have performed only five cases a year or up to 10 in 2 years.¹³

In our study, the median number of cases performed at hospitals with mortality rates within the two central quartiles of the nationwide mortality rates was 24 cases per year (IQR 10 to 34.5). Similarly, the median number of MT cases performed at hospitals with home discharge rates within two central quartiles of the nationwide home discharge rate was 23 per year (IQR 13.12 to 38.5). Because this number is derived solely from CMS data, it is almost certainly an underestimation of the actual or true volume of cases being performed at those hospitals. This suggests that the actual annual case volume required to achieve median mortality rates is higher than 24 per year. The results of the study suggest that previous consensus-based recommendations of 15 cases per year for a given center may be too low.⁷ Unfortunately, the optimal individual operator volume cannot be estimated from the CMS data because those data provide only aggregate case volume information. Nevertheless, it is possible to speculate that the hospital target of 24 cases and an individual volume of 15 cases per year is achievable for a center with two operators.

This is the first study that compares hospital volumes with accreditation status and identifies clear volume-related thresholds that affect discharge disposition to home and mortality. Given the limitations of these data, it may be difficult to present definitive recommendations; however, the data do suggest that the number of cases required to achieve optimal outcomes may be higher than consensus-based numbers used by the agencies

to accredit stroke centers. Additional studies will be needed to better identify volume standards for individual interventionists.

Limitations

The study has limitations. The database does not include private payer-only insurance data, which may be different with respect⁵ to demographics and clinical outcomes. Also, the CMS data are excellent for assessing the outcomes for institutions but individual operator-specific information is not available. This precludes an assessment of the effect of the annual case volume of individual operators on clinical outcomes. In addition, the data were not adjusted for baseline stroke severity because the MEDPAR database does not contain information about disease severity. Therefore, it is likely that differences in stroke severity might have influenced the outcomes at individual centers. Superior outcomes at certain centers may partly be due to patient selection rather than differences in clinical expertise and system efficiency because more procedures might have been performed on patients with higher National Institutes of Health Stroke Scale scores and more comorbidities at accredited CSCs. Unfortunately, the database does not provide the stroke severity for individual patients. Additionally, there may be transport bias with more complex cases being transferred to accredited ECCs.

CONCLUSION

This study provides critical information for policymakers, accreditation agencies, and care-giver organizations responsible for developing and approving recommendations for stroke systems of care. Nationwide registries may help to validate the findings of the current study and determine the association of individual operator ST volume with clinical outcomes.

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The author's relationships/activities/interests should be **defined broadly**. For example, if your manuscript pertains to the epidemiology of hypertension, you should declare all relationships with manufacturers of antihypertensive medication, even if that medication is not mentioned in the manuscript.

In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	None	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	None	
3	Royalties or licenses	None	

4	Consulting fees	None	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	None	
6	Payment for expert testimony	None	
7	Support for attending meetings and/or travel	None	
8	Patents planned, issued or pending	None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	None	
11	Stock or stock options	None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	None	
13	Other financial or non-financial interests	None	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form. X

ICMJE DISCLOSURE FORM

Date: 9/7/2021

Your Name: Jason M. Davies MD PhD

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript Number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

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The author's relationships/activities/interests should be defined broadly. For example, if your manuscript pertains to the epidemiology of hypertension, you should declare all relationships with manufacturers of antihypertensive medication, even if that medication is not mentioned in the manuscript.

In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

	Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work		
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None <div> <div></div> <div> Please note: I routinely provide full disclosure of relationships. The rationale for this is to avoid the omission of companies or studies whose devices may have been used in a procedure/case although not specifically named; to allow for technology from one company that may have influenced or been applied to another; to show that corporate bias does not exist; and to afford readers the opportunity to determine whether they feel a conflict of interest exists. </div> </div>
Time frame: past 36 months		
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input type="checkbox"/> None <div> <div>NIH NINDS</div> <div>NSF SBIR</div> </div>

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)								
3	Royalties or licenses	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
4	Consulting fees	<input type="checkbox"/> None <table border="1"> <tr><td>Medtronic</td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	Medtronic								
Medtronic											
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input type="checkbox"/> None <table border="1"> <tr><td>Medtronic</td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	Medtronic								
Medtronic											
6	Payment for expert testimony	<input type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
7	Support for attending meetings and/or travel	<input type="checkbox"/> None <table border="1"> <tr><td>Medtronic</td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	Medtronic								
Medtronic											
8	Patents planned, issued or pending	<input type="checkbox"/> None <table border="1"> <tr><td>QAS.ai</td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	QAS.ai								
QAS.ai											
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input type="checkbox"/> None <table border="1"> <tr><td>NIH NIHDS Strokenet</td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	NIH NIHDS Strokenet								
NIH NIHDS Strokenet											
10	Leadership or fiduciary role in other board,	<input type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> </table>									

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	<input type="checkbox"/> None	
		Synchron	RIST
		Cerebrotech	
		QAS,ai	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input type="checkbox"/> None	
<p>Please place an "X" next to the following statement to indicate your agreement:</p> <p><input checked="" type="checkbox"/> I certify that I have answered every question and have not altered the wording of any of the questions on this form.</p>			

ICMJE DISCLOSURE FORM

Date: 08/28/2021

Your Name: Victoria Lazarov

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

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1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None	

2	Grants or contracts from any entity (if not indicated in item #1 above).	<input checked="" type="checkbox"/> None	
3	Royalties or licenses	<input checked="" type="checkbox"/> None	
4	Consulting fees	<input checked="" type="checkbox"/> None	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input checked="" type="checkbox"/> None	
6	Payment for expert	<input checked="" type="checkbox"/> None	

	testimony		
7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None	
8	Patents planned, issued or pending	<input checked="" type="checkbox"/> None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input checked="" type="checkbox"/> None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	<input checked="" type="checkbox"/> None	
11	Stock or stock options	<input checked="" type="checkbox"/> None	

12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input checked="" type="checkbox"/> None	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 9/9/2021

Your Name: Bennett Levy

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript Number (if known): neurintsurg-2021-018079

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1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>						
Time frame: past 36 months								
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input type="checkbox"/> None <table border="1"> <tr> <td>Neurosurgery Research and Education Foundation Grant</td> <td>\$2,500 contributed to University at Buffalo Neurosurgery Department</td> </tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	Neurosurgery Research and Education Foundation Grant	\$2,500 contributed to University at Buffalo Neurosurgery Department				
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		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)								
3	Royalties or licenses	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
4	Consulting fees	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
6	Payment for expert testimony	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
8	Patents planned, issued or pending	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
10	Leadership or fiduciary role in other board,	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> </table>									

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	<input checked="" type="checkbox"/> None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input checked="" type="checkbox"/> None	
<p>Please place an "X" next to the following statement to indicate your agreement:</p> <p><input checked="" type="checkbox"/> I certify that I have answered every question and have not altered the wording of any of the questions on this form.</p>			

ICMJE DISCLOSURE FORM

Date: August 26, 2021

Your Name: Elad I Levy

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

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Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input type="checkbox"/> None 	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input type="checkbox"/> None 	
3	Royalties or licenses	<input type="checkbox"/> None	

4	Consulting fees	Claret Medical, GLG Consulting, Guidepoint Global, Imperial Care, Medtronic, Rebound, StimMed, Misionix, Mosiac, Clarion, IRRAS	Me
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	Medtronic	Me
6	Payment for expert testimony	I render medical/legal opinions as an expert	Me
7	Support for attending meetings and/or travel	Reimbursement for travel and food for some meetings with CNS and ABNS	Me
8	Patents planned, issued or pending	____ None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	____ None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	____ None	
11	Stock or stock options	NeXtGen Biologics, RAPID Medical, Claret Medical, Cognition Medical, Imperative Care, Rebound Therapeutics, StimMed, Three Rivers Medical	Me
12	Receipt of equipment, materials, drugs, medical writing, gifts or other	____ None	

	services		
13	Other financial or non-financial interests	<input type="checkbox"/> None	

Please place an “X” next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 12/6/2021

Your Name: J Mocco MD MS

Manuscript Title: "Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition"

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The following questions apply to the author's relationships/activities/interests as they relate to the current manuscript only.

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1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	PI on research trials funded by: Stryker Neurovascular, MicroVent, and Penumbra	Payments made to university or hospital to support the associated research
3	Royalties or licenses	<input checked="" type="checkbox"/> None	

4	Consulting fees	Cerebrotech, Viseon, Endostream, Vastrax, RIST, Synchron, Viz.ai, Perflow, and CVAid	Payments made to me
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	Invited speaker at Barrow Neurological Institute Grand Rounds (March 2020)	Honoraria payment made to me
6	Payment for expert testimony	<input checked="" type="checkbox"/> None	
7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None	
8	Patents planned, issued or pending	<input checked="" type="checkbox"/> None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input checked="" type="checkbox"/> None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	JNIS	Associate Editor, Editorial Board
		SNIS	President-Elect, Board of Directors
11	Stock or stock options	Investor in: Cerebrotech, Imperative Care, Endostream, Viseon, BlinkTBI, Myra Medical, Serenity, Vastrax, NTL, RIST, Viz.ai, Synchron, Radical, and Truvic	Payments made to me
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input checked="" type="checkbox"/> None	

Please place an “X” next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 12/2/21Your Name: MAXIM MOKINManuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge DispositionManuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The following questions apply to the author's relationships/activities/interests as they relate to the current manuscript only.

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In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input type="checkbox"/> None NIHR21NS109575	Not related to the current work
3	Royalties or licenses	<input checked="" type="checkbox"/> None	

4	Consulting fees	Cerenovus, Medtronic	None directly related to the current work
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input checked="" type="checkbox"/> None	
6	Payment for expert testimony	<input checked="" type="checkbox"/> None	
7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None	
8	Patents planned, issued or pending	<input checked="" type="checkbox"/> None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input checked="" type="checkbox"/> None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	JNIS Editorial Board	Assistant Editor: Technical Videos
11	Stock or stock options	<input type="checkbox"/> None BrainQ, Endostream, Serenity Medical, Synchron	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input checked="" type="checkbox"/> None	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 23 November 2021**Your Name:** Andre Monteiro MD**Manuscript Title:** Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition**Manuscript number (if known):** neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

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Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	None	
3	Royalties or licenses	None	

4	Consulting fees	None	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	None	
6	Payment for expert testimony	None	
7	Support for attending meetings and/or travel	None	
8	Patents planned, issued or pending	None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	None	
11	Stock or stock options	None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	None	
13	Other financial or non-financial interests	None	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form. X

ICMJE DISCLOSURE FORM

Date: 9/7/2021

Your Name: Tatsat Rajendra Patel

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript Number (if known): neurintsurg-2021-018079

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Time frame: Since the initial planning of the work								
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Time frame: past 36 months								
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>						

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)								
3	Royalties or licenses	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
4	Consulting fees	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
6	Payment for expert testimony	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
8	Patents planned, issued or pending	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
10	Leadership or fiduciary role in other board,	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> </table>									

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	<input checked="" type="checkbox"/> None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input checked="" type="checkbox"/> None	
<p>Please place an "X" next to the following statement to indicate your agreement:</p> <p><input checked="" type="checkbox"/> I certify that I have answered every question and have not altered the wording of any of the questions on this form.</p>			

ICMJE DISCLOSURE FORM

Date: 8/31/21

Your Name: Daniel O. Popoola

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The following questions apply to the author's relationships/activities/interests as they relate to the current manuscript only.

The author's relationships/activities/interests should be defined broadly. For example, if your manuscript pertains to the epidemiology of hypertension, you should declare all relationships with manufacturers of antihypertensive medication, even if that medication is not mentioned in the manuscript.

In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	None	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	None	
3	Royalties or licenses	None	

4	Consulting fees	None	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	None	
6	Payment for expert testimony	None	
7	Support for attending meetings and/or travel	None	
8	Patents planned, issued or pending	None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	None	
11	Stock or stock options	None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	None	
13	Other financial or non-financial interests	None	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 08/27/2021

Your Name: Ansaar T. Rai

Manuscript Title: "Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition."

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The following questions apply to the author's relationships/activities/interests as they relate to the current manuscript only.

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In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	____ None	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	____ None	
3	Royalties or licenses	____ None	

4	Consulting fees	Stryker Neurovascular Cerenovus MicroVention	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	___ None	
6	Payment for expert testimony	___ None	
7	Support for attending meetings and/or travel	___ None	
8	Patents planned, issued or pending	___ None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	___ None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	___ None	
11	Stock or stock options	___ None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	___ None	
13	Other financial or non-financial interests	___ None	

Please place an "X" next to the following statement to indicate your agreement:

 X I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 12-3-21

Your Name: Adnan H. Siddiqui

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The following questions apply to the author's relationships/activities/interests as they relate to the current manuscript only.

The author's relationships/activities/interests should be defined broadly. For example, if your manuscript pertains to the epidemiology of hypertension, you should declare all relationships with manufacturers of antihypertensive medication, even if that medication is not mentioned in the manuscript.

In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input type="checkbox"/> None Co-investigator for NIH - 1R01EB030092-01, Project Title: High Speed Angiography at 1000 frames per second; Mentor for Brain	Institution

		Aneurysm Foundation Carol W. Harvey Chair of Research, Sharon Epperson Chair of Research, Project Title: A Whole Blood RNA Diagnostic for Unruptured Brain Aneurysm: Risk Assessment Prototype Development and Testing	
3	Royalties or licenses	<input checked="" type="checkbox"/> None	
4	Consulting fees	<input type="checkbox"/> None Amnis Therapeutics, Apellis Pharmaceuticals, Inc., Boston Scientific, Canon Medical Systems USA, Inc., Cardinal Health 200, LLC, Cerebrotech Medical Systems, Inc., Cerenovus, Cerevatech Medical, Inc., Cordis, Corindus, Inc., Endostream Medical, Ltd, Imperative Care, Integra, IRRAS AB, Medtronic, MicroVention, Minnetronix Neuro, Inc., Penumbra, Q'Apel Medical, Inc., Rapid Medical, Serenity Medical, Inc., Silk Road Medical, StimMed, LLC, Stryker Neurovascular, Three Rivers Medical, Inc., VasSol, Viz.ai, Inc., W.L. Gore & Associates	Payments made to me
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input checked="" type="checkbox"/> None	
6	Payment for expert testimony	<input checked="" type="checkbox"/> None	

7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None	
8	Patents planned, issued or pending	<input type="checkbox"/> None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input type="checkbox"/> None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	Past Secretary – Board of the Society of NeuroInterventional Surgery 2020-2021	n/a unpaid
		Chair – Cerebrovascular Section of the AANS/CNS 2020-2021	n/a unpaid
11	Stock or stock options	<input type="checkbox"/> None Adona Medical, Inc., Amnis Therapeutics, Bend IT Technologies, Ltd., BlinkTBI, Inc, Buffalo Technology Partners, Inc., Cardinal Consultants, LLC, Cerebrotech Medical Systems, Inc, Cerevatech Medical, Inc., Cognition Medical, CVAID Ltd., E8, Inc., Endostream Medical, Ltd, Imperative Care, Inc., Instylla, Inc., International Medical Distribution Partners, Launch NY, Inc., NeuroRadial Technologies, Inc., Neurotechnology Investors, Neurovascular Diagnostics, Inc., PerFlow Medical, Ltd., Q'Apel Medical, Inc., QAS.ai, Inc., Radical Catheter Technologies, Inc., Rebound Therapeutics Corp. (Purchased 2019 by Integra Lifesciences, Corp), Rist Neurovascular, Inc. (Purchased 2020 by Medtronic), Sense Diagnostics, Inc., Serenity	Payments made to me

		Medical, Inc., Silk Road Medical, SongBird Therapy, Spinnaker Medical, Inc., StimMed, LLC, Synchron, Inc., Three Rivers Medical, Inc., TruVie Medical, Inc., Tulavi Therapeutics, Inc., Vastrax, LLC, VICIS, Inc., Viseon, Inc.	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input type="checkbox"/> None National PI/Steering Committees: Cerenovus EXCELLENT and ARISE II Trial; Medtronic SWIFT PRIME, VANTAGE, EMBOLISE and SWIFT DIRECT Trials; MicroVention FRED Trial & CONFIDENCE Study; MUSC POSITIVE Trial; Penumbra 3D Separator Trial, COMPASS Trial, INVEST Trial, MIVI neuroscience EVAQ Trial; Rapid Medical SUCCESS Trial; InspireMD C-GUARDIANS IDE Pivotal Trial	Payments made to me

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 9/13/2021

Your Name: Kenneth V Snyder, MD PhD

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript Number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

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In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

	Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work		
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None <div> <div></div> <div>Please note: I routinely provide full disclosure of relationships. The rationale for this is to avoid the omission of companies or studies whose devices may have been used in a procedure/case although not specifically named; to allow for technology from one company that may have influenced or been applied to another; to show that corporate bias does not exist; and to afford readers the opportunity to determine whether they feel a conflict of interest exists.</div> </div>
		Click the tab key to add additional rows.
Time frame: past 36 months		
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input checked="" type="checkbox"/> None <div> <div></div> <div></div> <div></div> </div>

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)								
3	Royalties or licenses	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
4	Consulting fees	<input type="checkbox"/> None <table border="1"> <tr> <td>Boston Scientific, Canon Medical Systems USA, Inc., MicroVention, Medtronic, Stryker Neurovascular</td> <td>Payments made to me</td> </tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	Boston Scientific, Canon Medical Systems USA, Inc., MicroVention, Medtronic, Stryker Neurovascular	Payments made to me							
Boston Scientific, Canon Medical Systems USA, Inc., MicroVention, Medtronic, Stryker Neurovascular	Payments made to me										
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input type="checkbox"/> None <table border="1"> <tr> <td>Canon Medical Systems USA Inc</td> <td>Payments made to me</td> </tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>	Canon Medical Systems USA Inc	Payments made to me							
Canon Medical Systems USA Inc	Payments made to me										
6	Payment for expert testimony	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
8	Patents planned, issued or pending	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
10	Leadership or	<input checked="" type="checkbox"/> None									

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	fiduciary role in other board, society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	<input type="checkbox"/> None	
		Boston Scientific, Access Closure Inc, Niagara Gorge Medical	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input checked="" type="checkbox"/> None	
<p>Please place an "X" next to the following statement to indicate your agreement:</p> <p><input checked="" type="checkbox"/> I certify that I have answered every question and have not altered the wording of any of the questions on this form.</p>			

ICMJE DISCLOSURE FORM

Date: 11/22/21

Your Name: Aquila S Turk DO

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The following questions apply to the author's relationships/activities/interests as they relate to the **current manuscript only**.

The author's relationships/activities/interests should be **defined broadly**. For example, if your manuscript pertains to the epidemiology of hypertension, you should declare all relationships with manufacturers of antihypertensive medication, even if that medication is not mentioned in the manuscript.

In item #1 below, report all support for the work reported in this manuscript without time limit. For all other items, the time frame for disclosure is the past 36 months.

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	None	
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	None	
3	Royalties or licenses	None	

4	Consulting fees	Cerebrotech Medical Systems, Inc.	Consultant/advisory board
		Endostream Medical, Ltd	
		Imperative Care	
		Medtronic	
		Serenity Medical, Inc.	
		Three Rivers Medical, Inc.,	
		Viz.AI, Inc.	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	None	
6	Payment for expert testimony	None	
7	Support for attending meetings and/or travel	None	
8	Patents planned, issued or pending	None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	None	
11	Stock or stock options	Bend IT Technologies, Ltd.	
		BlinkTBI, Inc	
		Cardinal Consultants, LLC	
		Cerebrotech Medical Systems, Inc	
		Endostream Medical, Ltd	
		Imperative Care, Inc	
		Instylla, Inc.,	
		Neurotechnology Investors	
		Q'Apel Medical, Inc.	
		Radical Catheter Technologies, Inc.	
		Rist Neurovascular, Inc. (Purchased 2020 by Medtronic)	

		Serenity Medical, Inc.	
		Spinnaker Medical, Inc.	
		Synchron, Inc.,	
		Three Rivers Medical, Inc	
		Truvic Medical, Inc.,	
		Tulavi Therapeutics, Inc.	
		Vastrax, LLC	
		VICIS, Inc	
		Viz AI	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	None	
13	Other financial or non-financial interests	COMPASS Trial	National PI/Steering Committee
		LARGE Trial	National PI/Steering Committee
		POSITIVE Trial	National PI/Steering Committee

Please place an “X” next to the following statement to indicate your agreement:

 X I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 8/26/2021

Your Name: Vincent M. Tutino

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript Number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

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Time frame: Since the initial planning of the work								
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) No time limit for this item.	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>						
Time frame: past 36 months								
2	Grants or contracts from any entity (if not indicated in item #1 above).	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>						

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)								
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4	Consulting fees	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
6	Payment for expert testimony	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
7	Support for attending meetings and/or travel	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
8	Patents planned, issued or pending	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
9	Participation on a Data Safety Monitoring Board or Advisory Board	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table>									
10	Leadership or fiduciary role in other board,	<input checked="" type="checkbox"/> None <table border="1"> <tr><td></td><td></td></tr> </table>									

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	<input checked="" type="checkbox"/> None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	<input checked="" type="checkbox"/> None	
13	Other financial or non-financial interests	<input checked="" type="checkbox"/> None	
<p>Please place an "X" next to the following statement to indicate your agreement:</p> <p><input checked="" type="checkbox"/> I certify that I have answered every question and have not altered the wording of any of the questions on this form.</p>			

ICMJE DISCLOSURE FORM

Date: 23 November 2021

Your Name: Muhammad Waqas MBBS

Manuscript Title: Stroke Thrombectomy Volume, Rather Than Stroke Center Accreditation Status of Hospitals, is Associated with Mortality and Discharge Disposition

Manuscript number (if known): neurintsurg-2021-018079

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The following questions apply to the author's relationships/activities/interests as they relate to the **current manuscript only**.

The author's relationships/activities/interests should be **defined broadly**. For example, if your manuscript pertains to the epidemiology of hypertension, you should declare all relationships with manufacturers of antihypertensive medication, even if that medication is not mentioned in the manuscript.

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Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	None	
3	Royalties or licenses	None	

4	Consulting fees	None	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	None	
6	Payment for expert testimony	None	
7	Support for attending meetings and/or travel	None	
8	Patents planned, issued or pending	None	
9	Participation on a Data Safety Monitoring Board or Advisory Board	None	
10	Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid	None	
11	Stock or stock options	None	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	None	
13	Other financial or non-financial interests	None	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form. X