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Letter to the Editor

Maintenance of Stroke Care Quality amid the Coronavirus Disease 2019 Outbreak in Taiwan

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Dear Sir:

It is well known that the implementation of evidence-based stroke care guidelines can effectively improve outcomes and prevent recurrence in patients with stroke.[1] In 2010, Taiwan implemented a nationwide collaborative model called the Breakthrough Series (BTS)-Stroke activity, adapted from the Get With The Guideline-Stroke program; this significantly improved outcomes on quality measures of acute ischemic stroke (AIS) care.[2]

During the coronavirus disease 2019 (COVID-19) pandemic, routine care of stroke may be compromised because of reallocation of medical resources. In Taiwan, the first confirmed COVID-19 case was reported on January 21, 2020. Because of the Taiwanese government's aggressive containment efforts,[3] the cumulative number of COVID-19 cases, as of May 2020, was as low as 442. Whether the number of daily admissions and quality metrics for stroke care changed during the COVID-19 pandemic period warrants investigation.

We retrospectively analyzed registry-based data from 18 hospitals in Taiwan, including seven medical centers and 11 community hospitals. The 18 hospitals were distributed in Taiwan's different administrative districts and contained >65% of the total

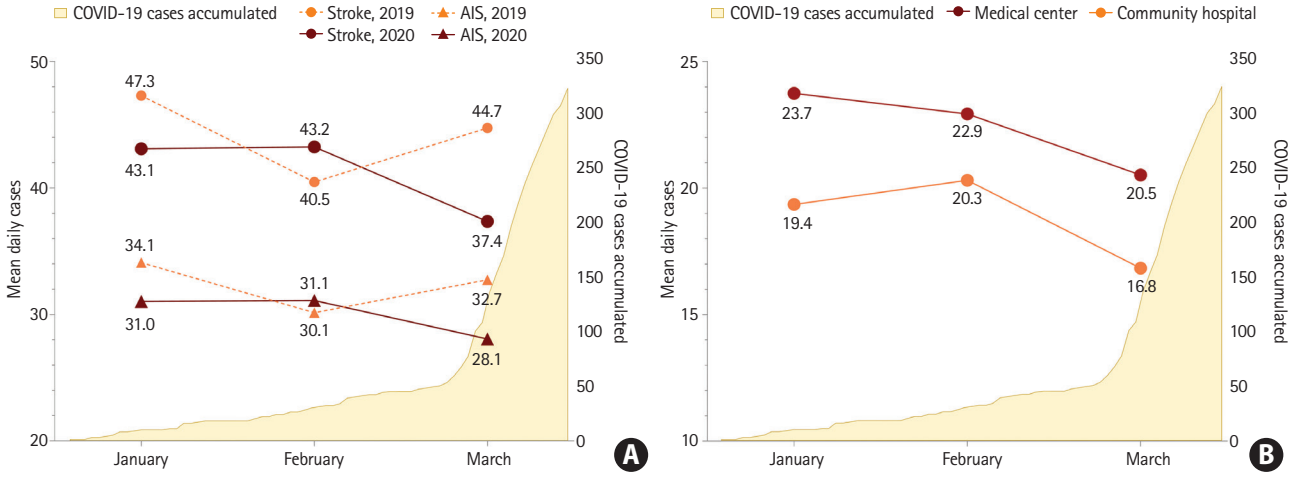

Figure 1. Trends of mean daily admissions of stroke between the first quarters of 2019 and 2020. (A) The rates of stroke and acute ischemic stroke (AIS) admissions decreased substantially over the first 3 months of 2020 (P<0.001 and P=0.03, respectively), but not in 2019 (P=0.13 and P=0.35, respectively). (B) The decrease of stroke admission rate in 2020 were consistently found in medical centers (P=0.007) and community hospitals (P=0.02). COVID-19, coronavirus disease 2019.

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population (Supplementary Table 1). All the hospitals had participated in the BTS-Stroke activity.[2] The performance measures and safety indicators were modified from the original BTS-Stroke quality metrics established in 2010 (Supplementary Table 2) and were reviewed monthly. Individual patient-level information was de-identified before analysis. Number of monthly admissions of stroke (including ischemic and hemorrhagic stroke) and 15 quality-of-care metrics were compared between the main outbreak (March 2020), early outbreak (January and February 2020), and control (January to March 2019) phases, respectively. Since the BTS-Stroke activity mainly focused on the AIS-related quality metrics, number of AIS admission were further recorded. Detailed methods and statistical analyses are presented in the Supplementary methods.

As the cumulative number of COVID-19 cases increased, there was a significant decrease in mean daily stroke admissions in the first quarter of 2020 (β=−0.07, *P*<0.001), which was not observed in 2019 (β=−0.03, *P*=0.13) (Figure 1A). Similar trends were observed in medical centers (β=−0.07, *P*=0.007) and community hospitals (β=−0.07, *P*=0.02) (Figure 1B).

The comparison between the first quarter of 2019 and 2020 was presented in Table 1. The number of daily stroke admission were decreased in 2020 compared with 2019 (41.2 vs. 44.3; incidence rate ratio [IRR], 0.93; *P*=0.001) as well as AIS admission (29.9 vs. 32.6; IRR, 0.93; *P*=0.001). The quality metrics were generally comparable, and several metrics of intravenous thrombolysis, endovascular thrombectomy, early and discharge antithrombotic use, and rehabilitation evaluation even improved in 2020.

Table 2 presents the aggregated data of stroke admissions and quality metrics across different study periods. During the main outbreak phase, the number of daily stroke admission was 37.4, which was an absolute decrease of 13% compared to the early outbreak phase (43.2; IRR, 0.87; *P*<0.001) and an absolute decrease of 16% compared to the control phase (44.3; IRR, 0.84;

Table 1. Comparison of the stroke admissions and quality metrics between the first quarter of 2020 and 2019

Study periods	Jan to Mar 2020	Jan to Mar 2019	Effect size, OR (95% CI)*	*P*
Mean daily admissions, total (day average)				
All stroke	3,748 (41.19)	3,986 (44.29)	0.93 (0.89–0.97)	0.001
AIS	2,734 (30.04)	2,916 (32.40)	0.93 (0.88–0.98)	0.001
AIS, medical centers	1,464 (16.09)	1,565 (17.39)	0.93 (0.86–0.99)	0.03
AIS, community hospitals	1,270 (13.96)	1,351 (15.01)	0.93 (0.86–1.00)	0.06
Early arrival (<2 hr) of AIS	18.1% (496/2,734)	14.6% (427/2,916)	1.29 (1.12–1.49)	<0.001
Stroke severity by NIHSS score				
<4/4–10/11–20/>20	1,060/874/424/282	1,237/972/421/277		0.11
Mild stroke (NIHSS <4)	40.2% (1,060/2,640)	42.6% (1,237/2,907)	0.91 (0.81–1.01)	0.07
Quality metrics, % (numerator/denominator)				
Door-to-CT ≤25 min	82.3% (408/496)	83.6% (357/427)	0.91 (0.65–1.28)	0.59
IV-tPA for early arrival	96.6% (198/205)	97.4% (151/155)	0.79 (0.24–2.59)	0.69
IV-tPA percentage	8.8% (238/2,696)	6.3% (183/2,900)	1.44 (1.18–1.76)	<0.001
Door-to-needle ≤60 min	66.4% (148/223)	66.9% (119/178)	0.98 (0.65–1.49)	0.92
Symptomatic ICH after IV-tPA	3.8% (9/237)	3.3% (6/182)	1.13 (0.41–3.13)	0.82
EVT percentage	8.0% (216/2,692)	5.4% (158/2,912)	1.46 (1.18–1.81)	<0.001
Symptomatic ICH after EVT	10.2% (22/216)	7.6% (12/158)	1.36 (0.66–2.80)	0.41
Dysphagia screening	96.6% (2,091/2,171)	95.7% (2,332/2,438)	1.19 (0.88–1.59)	0.26
Early antithrombotics use	98.6% (2,245/2,277)	97.6% (2,504/2,566)	1.72 (1.12–2.65)	0.01
Anticoagulants for AF	92.6% (349/377)	89.5% (323/361)	1.46 (0.88–2.43)	0.14
Lipid-lowering drugs use	94.3% (1,183/1,255)	93.9% (1,289/1,373)	1.07 (0.77–1.48)	0.68
Antithrombotics use at discharge	97.0% (2,181/2,248)	96.0% (2,394/2,495)	1.37 (1.00–1.87)	0.049
Rehabilitation evaluation	91.1% (2,044/2,243)	87.6% (2,190/2,501)	1.46 (1.21–1.76)	<0.001
Stroke education	97.3% (2,116/2,174)	96.5% (2,330/2,414)	1.31 (0.94–1.84)	0.12
30-day mortality	5.6% (129/2,318)	6.8% (174/2,559)	0.81 (0.64–1.02)	0.08

OR, odds ratio; CI, confidence interval; AIS, acute ischemic stroke; NIHSS, National Institutes of Health Stroke Scale; CT, computed tomography; IV-tPA, intravenous tissue plasminogen activator; ICH, intracerebral hemorrhage; EVT, endovascular thrombectomy; AF, atrial fibrillation.
*For rate data (case per day), the effect size was incidence rate ratio.

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Table 2. Comparison of the stroke admissions and quality metrics across the main outbreak phase, early outbreak, and control periods

Study periods	Main outbreak (Mar 2020)	Early outbreak (Jan to Feb 2020)	Effect size (compared with Mar 2020), OR (95% CI)*	*P*	Control (Jan to Mar 2019)	Effect size (compared with Mar 2020), OR (95% CI)†	*P*
Mean daily admissions, total (day average)							
All stroke	1,158 (37.35)	2,590 (43.17)	0.87 (0.81–0.93)	<0.001	3,986 (44.29)	0.84 (0.79–0.90)	<0.001
AIS	870 (28.06)	1,864 (31.07)	0.90 (0.83–0.98)	0.01	2,916 (32.40)	0.87 (0.80–0.93)	<0.001
AIS, medical centers	467 (15.06)	997 (16.62)	0.91 (0.81–1.01)	0.08	1,565 (17.39)	0.87 (0.78–0.96)	0.01
AIS, community hospitals	403 (13.00)	867 (14.45)	0.90 (0.80–1.01)	0.08	1,351 (15.01)	0.87 (0.77–0.97)	0.01
Early arrival (<2 hr) of AIS	18.4% (160/870)	18.0% (336/1,864)	1.03 (0.83–1.26)	0.82	14.6% (427/2,916)	1.31 (1.08–1.60)	0.01
Stroke severity by NIHSS score							
<4/4–10/11–20/>20	348/266/140/86	712/608/284/196		0.62	1,237/972/421/277		0.36
Mild stroke (NIHSS <4)	41.4% (348/840)	39.6% (712/1,800)	1.08 (0.92–1.28)	0.36	42.6% (1,237/2,907)	0.96 (0.82–1.12)	0.56
Quality metrics, % (numerator/denominator)							
Door-to-CT ≤25 min	76.9% (123/160)	84.8% (285/336)	0.59 (0.37–0.95)	0.03	83.6% (357/427)	0.65 (0.42–1.02)	0.06
IV-tPA for early arrival	96.6% (56/58)	96.6% (142/147)	0.87 (0.19–4.06)	0.86	97.4% (151/155)	0.67 (0.14–3.28)	0.62
IV-tPA percentage	7.4% (63/853)	9.5% (175/1,843)	0.76 (0.57–1.03)	0.08	6.3% (183/2,900)	1.19 (0.89–1.60)	0.25
Door-to-needle ≤60 min	64.9% (37/57)	66.9% (111/166)	0.91 (0.48–1.71)	0.77	66.9% (119/178)	0.91 (0.49–1.70)	0.77
Symptomatic ICH after IV-tPA	6.3% (4/63)	2.9% (5/174)	2.33 (0.64–8.45)	0.20	3.3% (6/182)	2.05 (0.59–7.13)	0.26
EVT percentage	8.5% (73/859)	7.8% (143/1,833)	1.10 (0.82–1.48)	0.52	5.4% (158/2,912)	1.62 (1.22–2.17)	0.001
Symptomatic ICH after EVT	12.3% (9/73)	9.1% (13/143)	1.42 (0.59–3.46)	0.43	7.6% (12/158)	1.73 (0.70–4.24)	0.23
Dysphagia screening	97.4% (608/624)	96.3% (1,489/1,547)	1.45 (0.83–2.52)	0.19	95.7% (2,332/2,438)	1.68 (0.995–2.85)	0.05
Early antithrombotics use	98.8% (666/674)	98.5% (1,579/1,603)	1.22 (0.55–2.67)	0.63	97.6% (2,504/2,566)	1.96 (0.95–4.03)	0.07
Anticoagulants for AF	89.0% (97/109)	94.0% (252/268)	0.51 (0.24–1.11)	0.09	89.5% (323/361)	0.93 (0.47–1.83)	0.83
Lipid-lowering drugs use	92.7% (354/382)	95.0% (829/873)	0.67 (0.41–1.09)	0.10	93.9% (1,289/1,373)	0.82 (0.52–1.27)	0.36
Antithrombotics use at discharge	96.1% (647/673)	97.4% (1,534/1,575)	0.66 (0.40–1.09)	0.10	96.0% (2,394/2,495)	1.04 (0.67–1.60)	0.88
Rehabilitation evaluation	91.1% (617/677)	91.1% (1,427/1,566)	1.00 (0.73–1.37)	0.99	87.6% (2,190/2,501)	1.45 (1.09–1.94)	0.01
Stroke education	98.7% (628/636)	96.7% (1,488/1,538)	2.51 (1.21–5.22)	0.01	96.5% (2,330/2,414)	2.68 (1.32–5.46)	0.01
30-day mortality	5.3% (40/750)	5.7% (89/1,568)	0.94 (0.64–1.38)	0.76	6.8% (174/2,559)	0.78 (0.55–1.11)	0.17

OR, odds ratio; CI, confidence interval; AIS, acute ischemic stroke; NIHSS, National Institutes of Health Stroke Scale; CT, computed tomography; IV-tPA, intravenous tissue plasminogen activator; ICH, intracerebral hemorrhage; EVT, endovascular thrombectomy; AF, atrial fibrillation.

*The effect size was the result of the early outbreak phase (Jan to Feb 2020) compared with the main outbreak phase (Mar 2020): incidence rate ratio for rate data (case per day) and OR for percentage data; †The effect size was the result of the control phase (Jan to Mar 2019) compared with the main outbreak phase (Mar 2020): incidence rate ratio for rate data (case per day) and OR for percentage data.

P<0.001). Compared with the early outbreak phase, quality metrics were largely comparable except for fewer patients having a door-to-computed tomography time ≤25 minutes in the main outbreak phase (76.9% vs. 84.8%; odds ratio [OR], 0.59; *P*=0.03). However, when compared to the control phase, the proportion of patients who arrived within 2 hours from stroke onset (18.4% vs. 14.6%; OR, 1.31; *P*=0.01) and those who received endovascular thrombectomy (8.5% vs. 5.4%; OR, 1.62; *P*=0.001) increased in the main outbreak phase. The quality metrics of rehabilitation evaluation and stroke education also improved.

We found that most stroke quality measures during the current study periods considerably improved compared to the initial BTS-Stroke activity implementation period of 2010 to 2011.[2] More importantly, the overall quality of acute stroke care was well-maintained or even further improved for several metrics during the early and main outbreak periods, indicating that the effect of the quality improvement program persists over time.

As expected, stroke admissions in Taiwan decreased by approximately 13% to 16% in the main COVID-19 outbreak phase in the main COVID-19 outbreak phase. However, the reduction appears much less than the global average of 42% reduction reported by the World Stroke Organization.[4] During the outbreak, patients with mild stroke symptoms may be less willing or may took longer time to visit the hospital.[5] Our data showed a trend of decreasing proportion of mild stroke (National Institutes of Health Stroke Scale [NIHSS] <4; 40.2% vs. 42.6%; OR, 0.91; *P*=0.07) and mild to moderate stroke (NIHSS <10; 73.3% vs. 76.0%; OR, 0.87; *P*=0.02) in 2020 compared with 2019. Besides, the number of early arrivals was higher in 2020 than 2019; these patients most likely had considerable neurological signs and were thus sent to hospitals earlier. The proportion of patients receiving acute reperfusion therapy did not decrease in 2020, suggesting that the quality of acute intervention of stroke were still maintained during the pandemic.

When encountering an outbreak of a highly contagious disease, the performance of timely and emergent acute stroke care could be compromised. Modification of the hyperacute stroke management protocol has been advocated during this pandemic in many countries, including Taiwan.[6,7] In this study, the proportion of patients with a door-to-computed tomography time ≤25 minutes was lower in the main outbreak phase, which would have resulted in delaying hyperacute stroke management.[8] Nevertheless, the proportion of patients with a door-to-needle time ≤60 minutes in our study was not affected, suggesting that the participating hospitals made their best effort to adhere to hyperacute stroke protocols.

The main limitation of our study was that we were able to use month-based hospital-level data only, and detailed individual patient-level data such as demographic profiles and stroke severities could not be analyzed. In addition, Taiwan was far less severely affected by the pandemic compared with other countries, hence the generalizability of our results should be taken into consideration.

In conclusion, we showed that the collateral adverse effect on stroke admission even in a country less affected by COVID-19. Well-implemented performance improvement program could lead to a fair maintenance of stroke care quality even during the public health crises.

Supplementary materials

Supplementary materials related to this article can be found online at https://doi.org/10.5853/jos.2020.02292.

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The authors have no financial conflicts of interest.

Supplementary methods

Participating hospitals

The data covered 18 hospitals in Taiwan's different administrative districts; these districts together contain >65% of the total population. The enrolled hospitals included seven medical centers and 11 community hospitals, and the corresponding principal investigators were all members of Taiwan Stroke Society (Supplementary Table 1) and participants of the BTS-Stroke activity, where they received training in the measurement of quality and safety from trained neurologists, study nurses, and stroke case managers. The details of the training and data collection process involved in the BTS-Stroke activity has been reported previously.[6] Individual patient-level information was de-identified before analysis. This study was approved by the National Taiwan University Hospital Research Ethics Committee, No. 202004035RINA.

Quality metrics for stroke care

The original BTS-Stroke quality metrics were established in 2010. It included 14 performance measures and safety indicators. These indicators are the percentage of (1) patients presenting with stroke symptoms for <2 hours who have a door-to-computed tomography time ≤25 minutes; (2) patients who arrived at the participating hospital <2 hours after symptom onset who use an intravenous tissue plasminogen activator (IV-tPA; IV-tPA for early arrival); (3) patients with acute ischemic stroke (AIS) who receive IV-tPA treatment; (4) patients who arrived <2 hours after symptom onset who have a of door-to-needle time ≤60 minutes; (5) patients who underwent IV-tPA treatment who developed symptomatic intracerebral hemorrhage (ICH); (6) patients with AIS who receive intraarterial thrombolysis; (7) patients who use antithrombotic medication use ≤48 hours upon admission (early antithrombotic use); (8) patients who undergo dysphagia screening before any oral intake; (9) patients with atrial fibrillation who are prescribed oral anticoagulants at discharge; (10) patients with a lipid-lowering drug prescription for low-density lipoprotein ≥100 mg/dL at discharge (lipid-lowering drug use); (11) patients with an antithrombotic prescription at discharge (antithrombotic use at discharge); (12) patients who are evaluated for stroke rehabilitation services (rehabilitation evaluation); (13) patients (and/or caregivers) who undergo stroke education (stroke education); and (14) patients with stroke who have a 30-day mortality. Since 2015, endovascular thrombectomy (EVT) has become the standard treatment for patients with AIS with large vessel occlusion. Therefore, we replaced intraarterial thrombolysis with EVT and added metric 15: symptomatic ICH after EVT (Supplementary Table 2). Stroke severity, representing by National Institutes of Health Stroke Scale (NIHSS), was not included in the BTS-Stroke activity. Nevertheless, we collected patients' NIHSS score according to four strata as <4, 4 to 10, 11 to 20, and >20.

All quality metrics were reviewed on a monthly basis in each participating hospital. Furthermore, the total number of monthly stroke admissions (including those of AIS, transient ischemic attack and hemorrhagic stroke) were recorded. Since the BTS-Stroke activity mainly focused on the AIS-related quality metrics, we further recorded number of AIS admission. The study period was January 1 to March 31, 2020, and the control period was January 1 to March 31, 2019.

COVID-19 statistics

Coronavirus disease 2019 (COVID-19) statistics were collected from the bulletins and press releases of the Central Epidemic Command Center (CECC), a specialized task force under Taiwan's Centers for Disease Control. We collected the daily numbers of confirmed cases (reported from home quarantine and enhanced surveillance).

Statistical analysis

The mean daily stroke and AIS admissions were calculated from data on their monthly counterparts (monthly figures/number of days of the month). The changes over the 3 consecutive months were estimated using a generalized estimating equation. The difference in the mean values between different study periods were compared using Poisson regression and expressed as incidence rate ratios and their 95% confidence intervals.

All quality metrics were represented as percentages (%). Because the denominator in these percentages may change according to which patients are covered by any given quality metrics, both the numerator and denominator are reported in the results. When appropriate, the chi-square test or Fisher's exact test was used to compare quality metrics between the study and control periods. Logistic regression analysis was used to calculate the odds ratios for quality of care between the 2 periods, and the penalized maximum likelihood (Firth method) was used for parameter estimation to determine the likelihood of rare outcomes.[7]

In brief, we first compared the first quarters of 2019 and 2020 with respect to the mean numbers of daily stroke admission of stroke and the quality-metric percentages. Prespecified subgroup analyses were performed for medical centers and community hospitals. Because the number of confirmed COVID-19 cases increased substantially in mid-March, we considered March 2020 as the most affected month (i.e., the main outbreak phase). Thus, we further compared data for March

2020 with those of January to February 2020 (i.e., the early outbreak phase) and the first quarter of 2019 (i.e., the control phase), respectively. All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

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Supplementary Table 1. List of the participating hospitals and team members of the Taiwan Stroke Society Investigators

Hospital	Accredited type	Districts	Team members
National Taiwan University Hospital	Medical center	Taipei city	Chih-Hao Chen, MD, PhD; Sung-Chun Tang, MD, PhD; Jiann-Shing Jeng, MD, PhD
Taipei Veterans General Hospital	Medical center	Taipei city	Nai-Fang Chi, MD; I-Hui Lee, MD, PhD
Tri-Service General Hospital	Medical center	Taipei city	Chung-Hsing Chou, MD, PhD; Jiunn-Tay Lee, MD
Mackay Memorial Hospital	Medical center	Taipei city	Ya-Ju Lin, MD, MSc; Helen L Po, MD
Shin Kong Wu Ho-Su Memorial Hospital	Medical center	Taipei city	Hsu-Ling Yeh, MD; Li-Ming Lien, MD, PhD
Linkou Chang Gung Memorial Hospital	Medical center	Taoyuan city	Chi-Hung Liu, MD, MSc; Chien-Hung Chang, MD; Tsong-Hai Lee, MD, PhD
National Cheng Kung University Hospital	Medical center	Tainan city	Yu-Ming Chang, MD; Pi-Shan Sung, MD
Keelung Chang Gung Memorial Hospital	Community hospital	Keelung city	Feng-Chieh Su, MD; Wen-Yi Huang, MD, PhD
Taipei Medical University Shuang-Ho Hospital	Community hospital	New Taipei city	Lung Chan, MD, PhD; Chaur-Jong Hu, MD, PhD
Taipei Tzu Chi Hospital	Community hospital	New Taipei city	Po-Jen Hsu, MD; Shinn-Kuang Lin, MD
Cardinal Tien Hospital	Community hospital	New Taipei city	Chung-Fen Tsai, MD, PhD; Ping-Keung Yip, MD
En Chu Kong Hospital	Community hospital	New Taipei city	Hai-Jui Chu, MD; Yu Sun, MD, PhD
Landseed International Hospital	Community hospital	Taoyuan city	Yu-Wei Chen, MD, PhD; Chi-Jen Chen, MD
National Taiwan University Hospital Hsin-Chu Branch	Community hospital	Hsinchu city	Hui-Chi Yang, BS; Kai-Hsiang Chen, MD
National Taiwan University Hospital Yunlin Branch	Community hospital	Yunlin county	Yiman Sun, BS; Kai-Chieh Chang, MD
Chiayi Chang Gung Memorial Hospital	Community hospital	Chiayi county	Chun-Hsien Lin, MD; Yen-Chu Huang, MD
Ditmanson Medical Foundation Chiayi Christian Hospital	Community hospital	Chiayi city	Yu-Hsiang Su, MD; Sheng-Feng Sung, MD, MS
E-Da Hospital	Community hospital	Kaohsiung city	Meng-Tsang Hsieh, MD; Tzu-Tung Tsai, MD

Supplementary Table 2. List of the quality metrics of stroke care

Quality metrics	Denominator	Numerator
Door-to-CT ≤25 min	Patients who arrived at a participating hospital <2 hr from symptom onset	Patients in the denominator who received head CT ≤25 min of hospital arrival
IV-tPA for early arrival	Patients who arrived at a participating hospital <2 hr from symptom onset, and fulfilled the indication for IV-tPA	Patients in the denominator who received IV-tPA
IV-tPA percentage	AIS patients admitted in the participating hospitals	Patients in the denominator who received IV-tPA
Door-to-needle ≤60 min	Patients who received IV-tPA	Patients in the denominator who received IV-tPA ≤60 min of hospital arrival
Symptomatic ICH after IV-tPA	Patients who received IV-tPA	Patients in the denominator who have symptomatic ICH
EVT percentage	AIS patients admitted in the participating hospitals	Patients in the denominator who received EVT
Symptomatic ICH after EVT	Patients who received EVT	Patients in the denominator who have symptomatic ICH
Dysphagia screening	AIS patients admitted in the participating hospitals	Patients in the denominator who received dysphagia screening before their first oral intake
Early antithrombotics use	AIS patients admitted in the participating hospitals	Patients in the denominator who received any antithrombotic agent (antiplatelets or anticoagulants) within 48 hr of hospital arrival
Anticoagulants for AF	AIS patients who have AF and are indicated for anticoagulation	Patients in the denominator who received anticoagulant
Lipid-lowering drugs use	AIS patients admitted in the participating hospitals who have LDL >100 mg/dL	Patients in the denominator who received any lipid-lowering agent at discharge
Antithrombotics use at discharge	AIS patients admitted in the participating hospitals	Patients in the denominator who received any antithrombotic agent (antiplatelets or anticoagulants) at discharge
Rehabilitation evaluation	AIS patients admitted in the participating hospitals	Patients in the denominator who received any rehabilitation evaluation
Stroke education	AIS patients admitted in the participating hospitals	Patients in the denominator who received any stroke education
30-day mortality	AIS patients admitted in the participating hospitals	Patients in the denominator who died within 30 day of hospital arrival

CT, computed tomography; IV-tPA, intravenous tissue plasminogen activator; ICH, intracerebral hemorrhage; EVT, endovascular thrombectomy; AIS, acute ischemic stroke; AF, atrial fibrillation; LDL, low-density lipoprotein.

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