Processes of stroke unit care and outcomes at discharge in Vietnam: findings from the REgistry of Stroke care Quality (RES-Q) in a major public hospital

Background

Stroke is a leading cause of global disease burden.[1] The burden of stroke is considerable in low-middle income countries (LMICs) accounting for 52% of prevalent strokes, 71% stroke-related deaths, and 78% of disability-adjusted life years lost, globally.[2] LMICs experience up to 23% greater incidence of stroke than high-income countries (HICs), and the gap continues to widen.[2] In HICs, the burden of stroke is related to the aging population while in LMICs, stroke occurs in younger ages mostly due to the greater prevalence of cardiovascular disease risk factors.[3]

Stroke is the leading cause of death, and the leading cause of years of life lost in Vietnam.[4] Over 20 years, the incidence of stroke in Vietnam has increased from 213.58/100,000 person-years in 1990 to 254.78/100,000 person-years in 2010.[2] More than 200,000 people have a new stroke each year, leading to 11,000 deaths nationwide.[5] In the 2013 Global Burden of Disease Study, the proportion of stroke-related mortality in Vietnam accounted for 32% of total deaths and was at the upper end of the global range (from 2% in Papua to 35% in Macedonia).[6] It is estimated that 1.5 million people in Vietnam (1.6% of the population; 2013) are living with the consequences of stroke.[7]

One of the greatest opportunities to reduce preventable death and disability after stroke is to ensure access to evidence-based treatment as recommended in clinical guidelines, such as the use of intravenous thrombolysis and prevention medication for risk factors.[8] Stroke clinical registries that incorporate standardized methods of data collection for processes of hospital care as well as

associated outcomes after stroke offer reliable guidance on how to reduce the impact of stroke.[9]

In Vietnam, systematic and standardized routine collection of outcome data to provide evidence of adherence to clinical guideline recommendations for stroke is unavailable.[10]

Our aims were to examine the processes of evidence-based care in hospital and outcomes at discharge among patients with acute first-ever stroke, and describe the factors associated with these outcomes from a major public hospital in Vietnam that admits approximately 15,000 strokes per year.

Methods

In this study, we included hospitalized patients with first-ever strokes (not including transient ischemic stroke) admitted between June 2017 and July 2018 to the stroke unit within the 115 People's Hospital - a major public hospital in Vietnam. This is a prospective observational study whereby standardized methods of data collection for processes of hospital care and outcomes were collected using the REgistry of Stroke Care Quality (RES-Q) system (see https://eso-stroke.org/res-q/). The RES-Q is a data collection tool of the European Stroke Organization – Enhancing and Accelerating Stroke Treatment (ESO-EAST) Project, a program to improve the stroke care system (see https://www.qualityregistry.eu/).

Study factors

A wide range of factors was recorded in the RES-Q registry, including patient characteristics and care received in hospital.[11] The factors investigated in the study included (1) socio-demographics: *age, sex;* (2) health behaviors/comorbidities: presence of atrial fibrillation, smoking status; (3) stroke-related factors: *stroke severity* assessed by the National Institutes of Health Stroke Scale (NIHSS)*, stroke type, in-hospital stroke* (stroke occurred during an episode

of admitted patient care for a different condition), *time from stroke onset to hospital arrival,* and *door-to-needle time for intravenous thrombolysis*; (4) discharge information: *length of hospital stay and discharge destination*; and (5) evidence-based processes of care provided while in hospital. The obtained information on hospital care included level-1 evidence-based processes of care according to clinical guidelines:[12,13]

Outcome measurement

In-hospital mortality was obtained from the patient medical records. *Functional outcome at discharge was indicated* by the ability to walk 10 meters without assistance at time of discharge.

Statistical analysis

Statistical analyses were performed using Stata 12.1 (StataCorp Texas, 2011).[14] All two-tailed p-values ≤ 0.05 were considered statistically significant.

We examined the differences in patient characteristics, processes of care, and outcomes using the $\chi 2$ test for categorical variables (e.g. stroke type) and *t* test or Wilcoxon signed-rank sum test, as appropriate for continuous variables (e.g. age, NIHSS score). Some medication restrictions may be appropriate given contraindications or to meet treatment guidelines.[13] We assumed that those presenting at hospital ≤ 3.5 hours of stroke onset needed about one additional hour for decision processes to occur to be eligible for thrombolysis treatment4.5 hours window after acute IS).[15] Missing data on processes of care were coded as not receiving the corresponding therapy.

We investigated factors that contributed to in-hospital mortality and functional outcome at discharge in log-binomial regression models using purposeful model building.[16] The model-building process was initially undertaken for each variable separately and then adjustments for all significant contributing factors (p<0.05) were examined in multivariable models.

Results

Patient characteristics

There was a total of 6,601 first-ever participants with stroke; with 44% being females (Table 1).
The median age was 62 years (interquartile range; IQR 53-72), and women generally were about
5 years older than men (median age 65, IQR 56-75 vs men 60, IQR 52-69; p<0.001). More than
two-fifths of the patients (42.1%; n=2,779) were current smokers, and the proportion was four
times greater in men compared to women (62.9% vs 15.7%; p<0,001). We detected 630 patients
with evidence of atrial fibrillation (86.4%) among 729 cases that were screened for atrial
fibrillation.

Stroke severity and stroke type

The median NIHSS score was 7 points (IQR 4-12). There were 569 cases (8.8%) presenting with
loss of consciousness (drowsy or comatose) at admission. There were only 34 (0.5%) strokes that
occurred while in the hospital. The majority of patients were found to have IS (79.9%), followed
by ICH (18.4%) while only a very small proportion had SAH (1.7%).

Processes of care

The median time from stroke onset to hospital arrival was 15.7 hours (IQR 5.6-37.5) and only
12% of all hospitalized patients with stroke were admitted to hospital ≤ 3.5 hours (Table 1).

Almost all hospitalized patients with stroke received neuroimaging (98.6%). Among those with
IS, 257 (4.9%) received carotid investigation ≤7 days after hospital admission. Carotid
endarterectomy or angioplasty/stenting ≤2 weeks after stroke onset were performed among 30
out of 345 (8.7%) of the patients with IS eligible for the procedures.

Of all patients admitted to the hospital with IS, 9.4% (n=497) were treated with intravenous thrombolytic therapy and they were all admitted to hospital ≤ 3.5 hours. Up to 11.6% (n=611) of IS cases underwent a recanalization procedure, including intravenous thrombolysis alone (n=377), endovascular treatment alone (n=114), or both (n=120). The median door-to-needle time for intravenous thrombolysis was 45 minutes (IQR 33-60).

Approximately one-third of the participants (32.8%) had assessment for rehabilitation needs ≤72 hours after hospital admission. Of those with ICH, surgical evacuation of the hematoma was performed among 17 cases (1.4%) and hemicraniectomy was used in 30 cases (8.7%). Almost all patients with stroke (99.5%) received dysphagia assessment/screening. In general, more than 90% of patients received secondary prevention therapies that were level-1 evidence-based processes of care: hypertensive agents (92.2%), cholesterol-lowering medication (IS; 99.0%), antithrombotic medication (IS; 97.9%).

The median length of hospital stay was 3 days (IQR 1-6) among those deceased within hospital and 4 days (IQR 3-6) for survivors at discharge. Of all cases, 88.9% were discharged home while only 3.1% (n=199) died. The remaining cases were either transferred to another hospital (2.0%), rehabilitation centers (5.1%), or long-term care facility/nursing home (1.0%). At discharge, nearly half (45.8%; n=2,931) of the survivors were able to walk 10 meters without assistance (Table 1). In multivariable models, more advanced age and severe strokes were contributing factors to mortality and poorer functional outcome at discharge. Being administered with antihypertensive agents was negatively associated with poorer outcomes after stroke (Table 2). In addition, the provision of cholesterol-lowering and antithrombotic medications was found to be significantly associated with better survival among those with IS (Table 2). There was no evidence of statistical interactions between covariates and the investigated outcomes.

The evidence-based care performances and discharge outcome varied across our study and some selected reports in national stroke registries in other LMICs (Table 3).

Discussion

The proportion of patients with IS receiving thrombolysis therapy has substantially increased from 0.6% in 2006, 3.2% in 2016 (unpublished data from the 115's People Hospital) to 9.4% in the present study, demonstrating the effort to improve the quality of stroke care at this hospital. This thrombolysis rate is greater than that of some selected stroke registries in LMICs (e.g. Thai Stroke Registry: 3.8%;[17] Taiwan Stroke Registry: 8.8%[18]). However, the considerable delay in the time from stroke onset to hospital arrival remains an important issue. More than 70% of those with stroke admitted to our stroke unit did not arrive ≤3.5 hours after experiencing stroke symptoms and they were then potentially ineligible for intravenous thrombolysis therapy. Within Vietnam, public misconceptions of stroke and use of inappropriate traditional therapies (e.g. coin rubbing) may contribute to delays in seeking acute stroke care in hospitals, limiting the options for evidence-based treatments.[10] The median door-to-needle time at the hospital, which has reduced to 45 minutes, achieved the initial goal recommended by the American Heart Association/American Stroke Association's target (≤ 60 minutes for at least 50% of acute IS patients).[19] Our ultimate aim should be to continue to improve the door-to-needle times of ≤60 minutes for all IS, as recommended in current clinical guidelines.[12]

Some aspects of care including assessment for rehabilitation needs and carotid investigation appeared to be more sub-optimal when compared to other LMICs (Table 3). This suggests a need for better understanding of the local barriers and enablers to improving the quality of care in this hospital and among other hospitals in Vietnam. For example, according to the China Stroke Registry II,[20] the reasons for lack of assessment for rehabilitation needs ≤72 hours after hospital

admission included the patients' condition that did not allow for assessment, patients/relative's refusal, and lack of personnel and equipment.

Outcomes at discharge

In the current study, in-hospital mortality was at 3.1%, similar to the findings from the previous hospital-based cohort at the 115 People's Hospital (3.1%; 2010)[21] and a population-based at a provincial hospital in Da Nang City, South-central Vietnam (3.3%; 2010).[22] The mortality is comparable to that of some national stroke registries in LMICs including Thai Stroke Registry (3.2%)[17] and Taiwan Stroke Registry (4.0%)[18] but lower than the figure in Bahrain (13.4%)[23] and Malaysia[24] (11.1%; Table 3). The low mortality rate is likely due to the short length of hospital stay (median: 4 days) and many hospitalized patients may go home to die. In a previous study conducted in our ward (2009-2010), the average total costs per stroke admission presented in United States (US) dollars were US$963 (including US$560 for direct medical cost).[25] Health insurance only covered about half of the direct medical costs and the total costs of stroke were 2.38 times greater than the median household income of the respondents in this study.[25] The long-term financial impact on families is of concern. Many stroke survivors are reliant on family members, many of whom are women (77%), for ongoing care[25] and is partly because post-stroke rehabilitation services are extremely limited and costly.[26] With the increasing numbers of stroke in Vietnam,[27] and the high-cost burden of treatment, it is important to implement effective treatment strategies to reduce the impact of this disease.

We found that processes of care including antihypertensive, cholesterol-lowering and antithrombotic medication were associated with better survival and functional outcome. This

could be translated that if the hospital could maximize their processes of care, the impact of stroke would be reduced. Apart from processes of care, age and stroke severity were found to be major predictors of in-hospital mortality and functional outcome. In the present study, stroke occured in younger age (approximately 10 years younger) compared to those in HICs. This is mostly due to the increased cardiovasular disease risk factors among adults.[3] The rate of smoking in men is very high compared to that in western countries.[28] In this registry, data on other risk factors for stroke (such as hypertension, diabetes) were not available, but evidence suggests that many people in Vietnam have uncontrolled hypertension, obesity, diabetes and unhealthy diet.[7] This emphasizes the importance to better manage cardiovascular risk factors such as high blood pressure, diabetes, or unhealthy behaviors (e.g. smoking, lack of exercise, unhealthy diets) in the general population to reduce the burden of stroke. Also, it is imperative to ensure access to evidence-based care for all people with stroke to lessen stroke severity and improve outcomes after stroke.

Further recommendations

There are currently about 1,500 hospitals across Vietnam.[29] There are limited resources and infrastructure for stroke care and treatment, including shortage of staff with expertise in stroke or who are upskilled to manage stroke according to best-practice in hospitals.[29] Only fewer than 10 stroke units are available to service a population of more than 80 million,[10] suggesting that the vast majority of patients may not receive adequate evidence-based care. Therefore, there is an urgent need for more stroke units and improved management of stroke as a medical emergency and greater provision of specialized care across the country.

Strengths and limitations

The analyses are based on a large dataset from a 13-month surveillance of 6,601 first-ever strokes admitted to the stroke unit of a major public hospital. Our results from high-quality data collected through the RES-Q platform, which is used in more than 50 countries,[30] will help inform future interventions to ensure systematic monitoring of the quality of stroke care and patient outcomes in Vietnam, which can guide policy and practice decisions. Since early 2017, Vietnam has contributed the greatest number of patients registered in the RES-Q central system (n=13,818; 8 Vietnamese hospitals).[31] There has been an increasing interest in using RES-Q for stroke registration in hospitals all over the world, and some preliminary findings have been presented as conference abstracts.[32,33]

The 115 People's Hospital is unique in Vietnam to have leading stroke specialists, and a Stroke Unit.[34] This can be seen in our study findings that, in our stroke unit, thrombolytic or endovascular therapy for acute IS had been undertaken for more than one case per day over the 13 months. Other limitations include that we were unable to track the survival status if a patient chose to die at home. Barriers to RES-Q included the inability to collect data on comorbidities (i.e. hypertension, diabetes), and patient outcomes after stroke beyond hospital (i.e. 90 days) and in the long term. Because of the cultural preferences for end-of-life care at home in Vietnam,[21] the mortality rate (3.1%) in this study is likely underestimated. Linkage of stroke incidence studies to the national death registrations offers a solution for the lack of long-term survival information in many HICs.[35] However, national registration systems for deaths remain uncommon in most LMICs[36] including Vietnam.

Conclusion

In our study, the considerable delay in the time from stroke onset to hospital arrival is of concern, suggesting an essential call for better strategies to increase public awareness for stroke

in Vietnam. Most hospitalized patients with acute stroke in the stroke unit within 115 People's Hospital received evidence-based care and have favorable outcomes. To achieve the favourable outcomes shown in the major public hospital, more stroke units and greater provision of specialized care across Vietnam and other LMICs are crucial.

Abbreviations

RES-Q: Registry of Stroke Care Quality. IS: ischemic stroke.

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Table 1. Characteristic of RES-Q registrants for stroke in the stroke unit in 115 People's Hospital during June 2017-July 2018 by sex

	n (%) or median (IQR)			
	Overall	Men	Women	P−value*
Number of cases	6,601	3,695 (56.0)	2,906 (44.0)	**<0.001**
Sociodemographics				
Age, median (IQR)	62 (53-72)	60 (52−69)	65 (56−75)	**<0.001**
Pre-stroke health				
Current smoker	2,779 (42.1)	2,324 (62.9)	455 (15.7)	**<0.001**
The presence of AF				
Detected by screening	630 (9.5)	284 (7.7)	346 (11.9)	**<0.001**
Undetected by screening	99 (1.5)	39 (1.1)	60 (2.1)	
Unscreened	5,872 (90.0)	3,372 (91.3)	2,500 (86.0)	
Stroke−related factors				
Stroke severity				
NIHSS, median (IQR)*	7 (4-12)	7 (4-11)	7 (4-12)	0.100
Loss of consciousness (drowsy/comatose)	569 (8.8)	313 (8.6)	256 (8.9)	0.671
In−hospital stroke	34 (0.5)	17 (0.5)	17 (0.6)	0.482
Type of stroke				
Ischemic stroke (IS)	5274 (79.9)	2911 (78.8)	2363 (81.3)	**0.023**
Intracerebral hemorrhagic (ICH)	1,217 (18.4)	714 (19.3)	503 (17.3)	
Subarachnoid hemorrhagic	110 (1.7)	70 (1.9)	40 (1.4)	
Processes of care				
Median time to hospital (hours)	15.7 (5.6-37.5)	14.2 (5.4-35.0)	18.5 (5.9-44.0)	0.827
Time to hospital				
≤ 3.5 hours	794 (12.0)	465 (12.6)	329 (11.3)	0.088
> 3.5 hours	4,670 (70.8)	2,583 (69.9)	2,087 (71.8)	
Missing	1,137 (17.2)	647 (17.5)	490 (16.9)	
Neuroimaging	6,497 (98.4)	3,695 (98.5)	2,858 (98.4)	0.659
Carotid investigation ≤7 days after hospital admission (IS)	257 (4.9)	126 (4.3)	131 (5.5)	**0.041**
Carotid endarterectomy or angioplasty/stenting ≤2 weeks after stroke onset (IS)	30 (8.7)	20 (8.1)	10 (10.2)	0.531
Intravenous thrombolysis (tPA; all cases)	497 (7.5%)	290 (7.9)	207 (7.1)	0.268
Intravenous thrombolysis (tPA; IS and admission time ≤3.5 hours)	497 (9.4%)	290 (10.0)	207 (8.8)	0.137
Recanalization procedures (IS)	611 (11.6)	349 (12.0)	262 (11.0)	0.309
tPA alone	377 (7.2)			

tPA + endovascular treatment	120 (2.2)			
endovascular treatment alone	114 (2.2)			
No	4,633 (88.4)			
Time to needle (mins, IQR)	45 (33-60)	45 (30-60)	45 (34-60)	1.000
Assessment for rehabilitation needs ≤72 hours after hospital admission	2,166 (32.8)	1,155 (31.3)	1,011 (34.8)	**0.002**
Surgical thrombectomy (ICH)	17 (1.4)	13 (1.8)	4 (0.8)	0.133
Hemicraniectomy (ICH)	30 (8.7)	20 (8.1)	10 (10.2)	0.531
Dysphagia screening	6,565 (99.5)	3,672 (99.4)	2,893 (99.6)	0.338
Dysphagia screening (IS)	5,241 (99.4)	2,980 (99.3)	2,351 (99.5)	0.328
Antihypertensive agent†	5,902 (92.2)	3,299 (91.8)	2,603 (92.7)	0.179
Cholesterol-lowering medication†	5,071 (79.2)	2,808 (78.1)	2,263 (80.6)	0.016
Cholesterol-lowering medication (IS)†	5,071 (99.0)	2,808 (99.0)	2,263 (99.0)	0.954
Antithrombotic medication (IS)†	5,016 (97.9)	2,771 (97.7)	2,245 (98.2)	0.185
Discharge information				
LOS if discharged, median (IQR)	3 (1-6)	3 (1-5)	3 (1-7)	0.781
LOS if deceased, median (IQR)	4 (3-6)	4 (3-6)	4 (3-6)	0.100
Discharge destination				
Home	5,869 (88.9)	3,275 (88.6)	2,594 (89.2)	0.139
Rehabilitation facility	334 (5.1)	197 (5.3)	137 (4.7)	
Long-term care facility/nursing home	66 (1.0)	44 (1.2)	22 (0.8)	
Other hospital	133 (2.0)	78 (2.1)	55 (1.9)	
Died	199 (3.1)	101 (2.7)	98 (3.4)	
Able to walk 10 meters without assistance†	2,931 (45.8)	1,688 (47.0)	1,243 (44.3)	**0.031**

Length of stay: LOS. IQR: Interquartile range. Of note, missing data on processes of care were coded as not receiving the corresponding therapy

*missing data <10%

†among those discharged

Table 2. Predictors of outcomes at discharge in univariable and multivariable models*

Covariate	In-hospital mortality		Poorer functional outcome	
	Univariable model RR (95% CI)	Multivariable model RR (95% CI)	Univariable model RR (95% CI)	Multivariable model RR (95% CI)
Model 1 (All strokes)				
Age	1.04 (1.03-1.05)	1.02 (1.01-1.03)	1.01 (1.00-1.01)	1.00 (1.00-1.01)
NIHSS	1.18 (1.16-1.20)	1.10 (1.08-1.12)	1.08 (1.08-1.09)	1.08 (1.08-1.09)
Antihypertensive agent(s)	0.01 (0.01-0.02)	0.02 (0.01-0.04)	1.13 (0.99-1.28)	1.14 (1.00-1.31)
Model 2 (Ischemic strokes)				
Age	1.05 (1.03-1.07)	ns	1.01 (1.00-1.01)	1.01 (1.00-1.01)
NIHSS	1.18 (1.16-1.20)	ns	1.08 (1.08-1.09)	1.08 (1.08-1.09)
Antihypertensive agent(s)	0.01 (0.006-0.02)	0.30 (0.14-0.63)	1.02 (0.89-1.17)	ns
Cholesterol-lowering medication	0.002 (0.001-0.004)	0.02 (0.006-0.06)	0.66 (0.49-0.91)	ns
Antithrombotic medication	0.004 (0.002-0.007)	0.23 (0.09-0.61)	0.67 (0.53-0.83)	ns

RR: relative risk; CI: confidence interval; not significant; NIHSS: National Institute of Health Stroke Scale, ns: not statistically significant (p<0.05)

*Only significant variables (p<0.05) were retained in the multivariable models
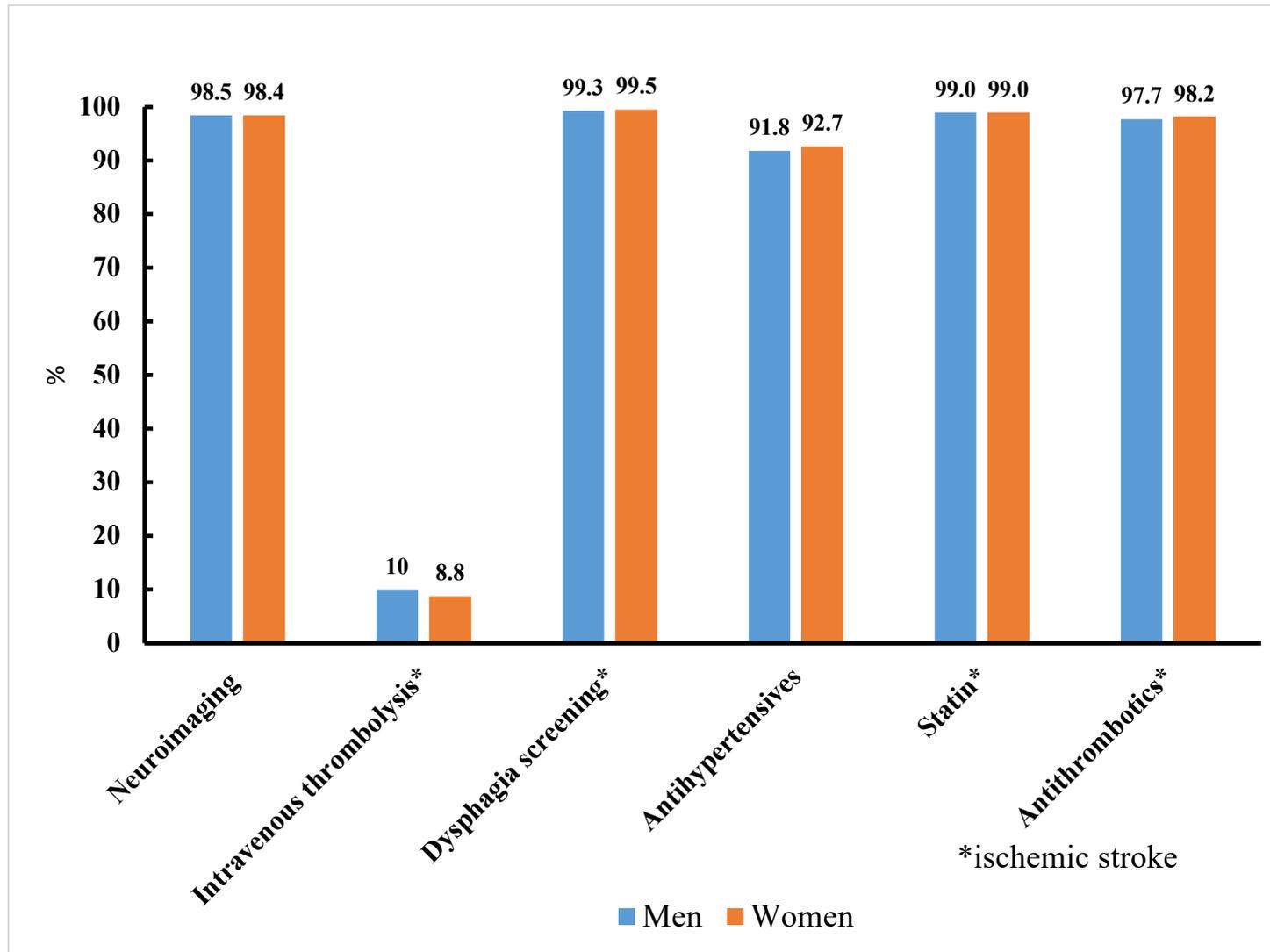
Figure 1. Evidence-based care received in the stroke unit in 115 People's Hospital among hospitalized patients with acute stroke during Jun 2017 and Mar 2018 registered in the RES-Q

Table 3. Characteristic of RES-Q registrants for stroke in the 115 People's Hospital compared with other stroke registries from selected low- and middle-income countries

	RES-Q Vietnam (n=6,601)	Thai Stroke Registry[1] (n=1,222)	China Stroke Registry II[2] (n=19,294)	Bahrain[3] (n=521)	National Stroke Registry (Malaysia; n=1,018)[4]	Taiwan Stroke Registry[5] (n=30,599)
Year	Jun 17-Jul 18	Jun 08 – Nov 10	Jun 12 – Jan 13	2011	Aug 09 – Dec 10	06-08
Women (%)	44	45	37	34	46	40
Sociodemographics						
Age, median (IQR); or mean (SD)	62 (53-72)	mean: 65.0 (13.0)	65 (57-74)	mean: 60.5 (na)	mean: 62.5 (na)	70 (60-78)†
Pre-stroke health						
Current smoker (%)	42.1		44.2			40.4†
Atrial fibrillation (AF; %)	9.5		7.1			16.5†
Stroke−related factors						
Stroke severity						
NIHSS, median (IQR)*	7 (4-12)	6.5 (3-12)	4 (2-7)			5 (2-9)†
Loss of consciousness (drowsy/comatose; %)	8.8			32.6		
Type of stroke (%)						
Ischemic stroke (IS)	79.9	100	100	60.0	73.3	74.0
Intracerebral hemorrhagic (ICH)	18.4	excluded	excluded	20.0	20.9	16.1
Subarachnoid hemorrhagic	1.7	excluded	excluded	3.0	1.7	2.8
Processes of care (%)						
Neuroimaging	98.4	100		88.2		92.1†
Stroke unit access	100.0	24.6				
Carotid imaging before discharge (IS)	4.9 (≤7 days)	13.1	67.0	34.7		
Intravenous thrombolysis (IS; %)	9.4	3.8				8.8

Assessment for rehabilitation needs ≤72 hours after hospital admission (%)	32.8		64.8 (before discharge)	52.8		
Dysphagia screening	99.5		84.4	20.3 (≤24 hours)	83.0	
Antihypertensive agent*	92.2	31.0		79.0		
Cholesterol-lowering medication*	79.2	73.4		82.0	87.0	
Cholesterol-lowering medication* (IS)	99.0					38.7
Antithrombotic medication (IS)*	97.9		65.9	83.0	38.6	94.1
Aspirin administration≤48 hours				82.3	85.7	
Antiplatelet agent(s) at discharge		80.1			84.4	85.5
Anticoagulants if AF		39.8			39.4	28.3
Discharge information						
Length of stay, median (IQR)	4 (3-6)	4 (3-7)	13 (9-16)			8 (5-15)†
Length of stay, mean (SD)				15.4 (?)	5.1 (?)	
In-hospital mortality (%)	3.1	3.2		13.4	11.1	4.0†

na: not available; SD: standard deviation; IQR: interquartile range

*among those discharged

†among IS

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