

Supplementary materials to: Lim DST, Rahmat SRB, Hong DZ, et al.
Stroke publications in Southeast Asia: A bibliometric analysis.
Ann Acad Med Singap 2026;55:444-6.
DOI: <https://doi.org/10.47102/annals-acadmedsg.2026151>

Supplementary Annex S1. Search strategy.

A search of PubMed was conducted on 28 July 2024 to identify publications indexed between 1 June 2020 and 31 May 2024. The search incorporated current and alternative geographical names where applicable (e.g. "Timor-Leste" and "East Timor"; "Southeast Asia" and "South-east Asia"). Retrieved records were manually screened, and publications were included if stroke or transient ischaemic attack was the primary focus and at least one author had an affiliation with an institution in an ASEAN country. Country attribution was determined by manual review of author affiliations. Publications involving authors from multiple ASEAN countries were assigned to each contributing country (full-counting approach) but counted only once in the overall publication total.

Search strategy: [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Southeast Asia" OR "South-east Asia" OR "South east Asia")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Brunei")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Cambodia")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Timor-Leste" OR "East Timor")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Indonesia")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Laos")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Malaysia")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Myanmar")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Philippines")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Singapore")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Thailand")] OR [("stroke" OR "cerebrovascular accident" OR "transient ischaemic attack") AND ("Vietnam")]

Supplementary Fig. S1. PRISMA flow diagram.

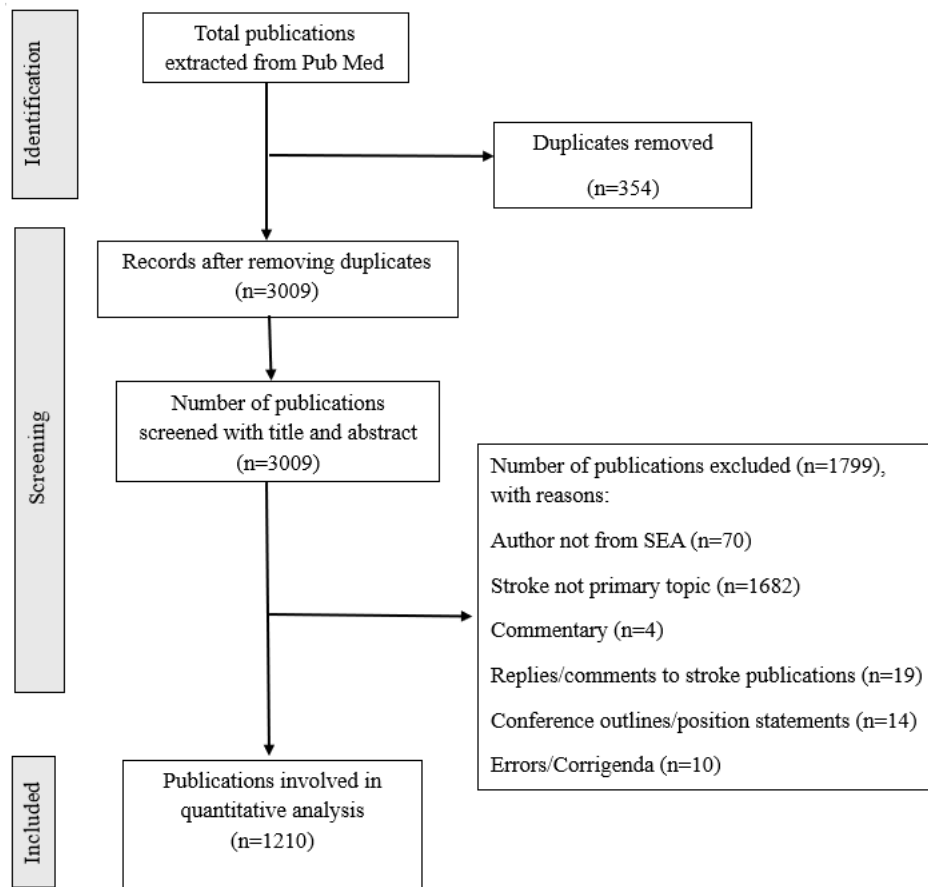


Table S1. Details of information gathered for each eligible publication.

Variable	Item	Definition
Research category	Assessment and scoring tools (<i>non-imaging</i>)	Publications evaluating, developing, validating, comparing, or applying clinical assessment instruments, screening tools, or prognostic scoring systems used in stroke care.
	Audit	Publications evaluating adherence to clinical guidelines, quality improvement initiatives, healthcare performance, service delivery, or benchmarking of stroke care against predefined standards.
	Caregiving	Publications focusing on informal caregivers or family members, including caregiver burden, caregiver education, support programmes, caregiver mental health, and caregiver experiences.
	Complications	Publications examining medical, neurological, or procedural complications that occur as a consequence of stroke or its treatment.
	Decision-making and quality-of-life	Publications investigating patient preferences, shared decision-making, treatment choices, patient-reported outcomes, health-related quality of life, utility measures, or ethical aspects of stroke care.
	Diagnosis and hyperacute management	Publications addressing recognition, diagnosis, emergency evaluation, or treatment during the hyperacute phase of stroke (typically within the first 24 hours), including thrombolysis, thrombectomy, emergency triage, and acute management pathways.
	Education and health literacy (<i>patients and the population-at-large</i>)	Publications evaluating educational interventions, stroke awareness campaigns, public knowledge, patient education, healthcare professional education, or health literacy related to stroke.
	Epidemiology	Publications describing the frequency, distribution, trends, incidence, prevalence, mortality, burden, or demographic characteristics of stroke within populations.

	Healthcare policy and socioeconomics	Publications examining health systems, policy, healthcare access, resource allocation, insurance, costs, cost-effectiveness, disparities, or socioeconomic determinants affecting stroke care.
	Imaging (including scoring systems)	Publications focusing primarily on imaging modalities, imaging biomarkers, image interpretation, imaging protocols, or imaging-based scoring systems used in stroke diagnosis or management.
	Miscellaneous/ not classifiable (<i>case reports, anecdotal evidence, overview of stroke</i>)	Publications that did not fit any predefined category or whose primary objective was descriptive rather than hypothesis-driven, including: case reports, anecdotal evidence, overview of stroke
	Non-hyperacute management (<i>secondary prevention</i>)	Publications examining management after the hyperacute phase, including inpatient care, chronic management, secondary prevention, long-term medical therapy, and follow-up care.
	Outcomes and prognosis	Publications investigating clinical outcomes, predictors of recovery, mortality, disability, recurrence, or long-term prognosis following stroke.
	Pathophysiology and basic sciences	Laboratory, translational, genetic, molecular, cellular, or animal studies investigating mechanisms underlying stroke or experimental stroke therapies.
	Recovery and rehabilitation	Publications examining rehabilitation interventions, neuroplasticity, functional recovery, rehabilitation services, assistive technologies, or therapies aimed at improving post-stroke function.
	Risk factors and prevention	Publications identifying, evaluating, or modifying factors associated with the occurrence of a first-ever stroke, including lifestyle, medical, genetic, or environmental risk factors and primary prevention strategies.
	Risk stratification (<i>primary and secondary risk of stroke</i>)	Publications developing, validating, or applying prediction models or risk scores

		estimating the probability of stroke occurrence or recurrence.
Study type	Bibliometric	Studies using bibliometric or scientometric methods to quantitatively analyse the characteristics, trends, citation patterns, collaboration networks, or research output of published literature.
	Case-series	Descriptive studies reporting clinical characteristics, management, or outcomes of a group of patients with the same condition, without a comparison group.
	Case-control	Observational studies comparing participants with the outcome of interest (cases) to those without the outcome (controls) to identify associated exposures or risk factors.
	Case-report	Detailed description of a single patient or a very small number of patients, typically highlighting unusual clinical features, diagnosis, treatment, or outcomes.
	Clinical trial (<i>trials without a control</i>)	Prospective interventional studies evaluating an intervention in a single group without a concurrent control or comparison arm.
	Cohort	Observational studies following participants over time (prospectively or retrospectively) according to exposure or baseline characteristics to evaluate subsequent outcomes.
	Cross-over	Interventional studies in which participants receive two or more interventions sequentially, with each participant serving as their own control.
	Cross-sectional	Observational studies collecting exposure and outcome data at a single point in time without longitudinal follow-up.
	Descriptive	Studies primarily describing patient characteristics, disease patterns, healthcare utilisation, or clinical experience without formal hypothesis testing or analytical comparisons.
	Economic	Studies evaluating the economic aspects of stroke care, including cost analyses, cost-effectiveness analyses, cost-utility analyses,

		budget impact analyses, or healthcare resource utilisation
	Editorials and commentaries	Non-original publications expressing expert opinions, perspectives, commentary, or discussion regarding stroke research, policy, or clinical practice.
	Genetic study (<i>analysis of genetic database information</i>)	Studies investigating genetic factors associated with stroke, including genome-wide association studies (GWAS), sequencing studies, polygenic risk analyses, Mendelian randomisation, or analyses of genetic databases.
	Guideline	Publications providing evidence-based clinical practice guidelines, consensus recommendations, or position statements developed by professional organisations or expert panels.
	In vitro or in vivo	Experimental laboratory studies conducted in cell cultures (in vitro) or animal models (in vivo) to investigate stroke mechanisms, pathophysiology, or experimental therapies.
	Meta-analysis	Studies quantitatively synthesising results from multiple independent studies using statistical pooling methods.
	Post-hoc analysis	Secondary analyses of data collected from previously completed studies or clinical trials to investigate additional research questions beyond the original study objectives.
	Quasi-experimental (non-randomised trials)	Interventional studies evaluating an intervention without random allocation of participants to study groups.
	Randomised controlled trial	Experimental studies in which participants are randomly assigned to intervention and control groups to evaluate the effectiveness or safety of an intervention.
	Scoping review	Knowledge synthesis studies systematically identifying and mapping the available literature on a broad topic without quantitatively pooling results or formally assessing study quality.
	Study rationale and methodology	Publications describing the rationale, objectives, study protocol, methodology, statistical analysis plan, or design of an

		ongoing or planned study without reporting primary study results.
	Systematic review	Studies systematically identifying, appraising, and synthesising existing evidence using predefined eligibility criteria and reproducible search methods, without statistical meta-analysis.
	Technology development <i>(e.g. algorithms for automated imaging interpretation)</i>	Studies primarily focused on the development or technical evaluation of new technologies, software, artificial intelligence algorithms, machine learning models, imaging tools, wearable devices, or digital health applications relevant to stroke diagnosis, management, or rehabilitation.
	Validation	Studies evaluating the diagnostic accuracy, reliability, reproducibility, calibration, discrimination, or external performance of an existing clinical tool, prediction model, biomarker, questionnaire, imaging method, or assessment instrument.
Collaboration	Within ASEAN	Publications with authors whose listed affiliated institution on said publication were exclusively in countries within ASEAN.
	With authors affiliated outside ASEAN (INTL)	Publications with authors whose listed affiliated institution on said publication were in only one country in ASEAN and countries within ASEAN.
	With both ASEAN and INTL authors	Publications with authors whose listed affiliated institution on said publication were in both ASEAN and non-ASEAN countries.
	None	Publications with authors whose listed affiliated institution on said publication were from one country in ASEAN.
Others	Journal reach (<i>Local, Asian, International</i>)	Local – publication was in journal whose listed country in WOS was in ASEAN. Asian – publication was in journal whose listed country in WOS was in Asia, including the middle east, but not ASEAN. International – publication was in journal whose listed country in WOS was not in Asia or ASEAN.

Table S2. Summary of socioeconomic markers of ASEAN countries.

Country	SG	THA	MAS	IDN	VNM	PHL	MMR	BRN	KHM	LAO	TL
Population as of 2024 (by nearest million)	5.83	71.67	35.56	283.49	100.99	115.84	54.50	0.46	17.64	7.77	1.40
GDP per capita in USD in thousands ¹	86.38	7.21	12.1	4.92	4.32	3.91	1.23	33.67	2.43	1.98	1.51
Current Health expenditure (% of GDP) in 2021	5.57	5.16	4.38	3.71	4.59	5.1	5.63	2.2	7.53	2.74	11.44
Change in domestic government health spending per CHE	4.3	-1.9	-1.7	3.2	3	4.5	-4.9	-2.2	0.6	-6.1	14.3
% change in priority to health	1.9	2.8	-0.5	-0.5	0.5	1.2	-0.7	-0.1	0	-0.9	4.7
Number of neurologists in 2024 ²	140	573 ³	140	2361	402	703	39	6	32	12	3

¹ IMF GDP per capita in USD in 2024² From 2025 paper Education Research: Training of neurologists in ASEAN countries³ No updated date from paper available for Thailand, from neuronetwork in 2025

No of neurologists per 1 million population in 2024	24.0	7.99	3.94	8.32	3.98	6.07	0.72	13.1	1.81	1.54	2.14
R&D% of GDP	2.16 ⁴	1.21 ⁵	0.04 ⁵	0.12 ⁶	0.43 ⁷	0.32 ⁸	0.95 ⁴	0.28 ⁸	0.28 ⁴	no data	no data
UHC Service Coverage Index 2021	88.5	82	76	54.8	68.1	58.2	52.4	78.3	58	51.8	52.3
UHC effective Coverage index for stroke treatment 2019	100	65	59	33	26	42	3	74	24	26	33

⁴ 2020

⁵ 2022

⁶ 2015

⁷ 2021

⁸ 2018

Table S3. Summary of bibliometric indexes of stroke publications in ASEAN post-May 2020.

Country	ASEAN	SG	THA	MAS	IDN	VNM	PHL	MMR	BRN	KHM	LAO	TL	Total
Search results	60	1299	658	562	325	222	175	24	25	10	3	0	3363
Eligible publications													
By country (n; % total of searched publications for respective country)	20 (33.3)	481 (37.0)	262 (39.8)	241 (42.9)	152 (46.8)	103 (46.4)	58 (33.1)	7 (29.2)	6 (24.0)	1 (10.0)	1	0	1210 (after removal of duplicates)
By all of ASEAN (% total of eligible publications ¹)		39.8	21.7	19.9	12.6	8.5	4.8	0.6	0.5	0.1	0.1	0	NA
By share of country-level author contributions ² (%)		36.6	20.0	18.4	11.6	7.9	4.4	0.5	0.4	0.1	0.1	0	NA
Stroke- COVID-19		25	11	13	23	5	9	0	1	0	0	0	74

¹ Out of eligible publications (unique publications): n = 1,210² Out of country-level publication counts (including multi-country publications): n = 1,312

Publications (n, % stroke- COVID-19 publications ³)		(33.78)	(14.86)	(17.57)	(31.08)	(6.76)	(12.16)	(0.0)	(1.35)	(0.0)	(0.0)	(0.0)	
Collaborations													
By country (n; % total)		207 (43.0)	128 (48.9)	122 (50.6)	99 (65.1)	38 (36.9)	26 (44.8)	1 (14.3)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	612 (50.6)
With ASEAN countries only (% collabs)		11 (2.3)	3 (1.1)	11 (4.5)	6 (3.9)	2 (1.9)	2 (3.4)	1 (14.3)	1 (16.7)	1 (100.0)	1 (100.0)	0 (0.0)	21 (0.2)
With non- ASEAN countries only (% collabs)		238 (49.5)	112 (42.7)	89 (36.9)	31 (20.4)	50 (48.5)	19 (32.8)	1 (14.3)	4 (66.7)	0 (0.0)	0 (0.0)	0 (0.0)	532 (44.0)
With both ASEAN and non-ASEAN countries (% collabs)		25 (5.2)	19 (7.3)	19 (7.9)	16 (10.5)	13 (12.6)	11 (19.0)	4 (57.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	45 (3.72)
Journal origin													
INTL (n; % total)		441 (91.7)	229 (87.4)	197 (81.7)	130 (85.5)	96 (93.2)	54 (93.1)	5 (71.4)	4 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	1057 (87.4)

³ Out of 74 total distinct stroke-covid papers with no duplicates

ASIA (n; % total)		24 (5.0)	29 (11.0)	21 (8.7)	19 (12.5)	4 (3.9)	1 (1.7)	1 (14.3)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	78 (6.4)
LOCAL (n; % total)		15 (3.1)	0 (0.0)	19 (7.9)	3 (2.0)	0 (0.0)	2 (3.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	39 (3.2)
Journal Impact Factor (IF)													
Median IF (IQ range)		2.8 (2.2- 4.8)	2.8 (2.0- 4.0)	2.7 (1.7- 3.8)	2.1 (1.5- 2.9)	2.9 (2.0- 4.65)	2.4 (2.0- 3.2)	3.6 (2.5- 5.0)	2.1 (1.65- 2.70)	Not in WoS	Not in WoS	NA	2.7 (2.0-4.1)
JIF range		0.6- 98.4	0.8- 28.2	0.4- 46.5	0.6- 46.5	0.6- 98.4	0.6- 12.0	2.0- 5.8	1.5- 3.0	Not in WoS	Not in WoS	NA	0.4-98.4
JIF $\geq$ 2.0 (n,% of country's eligible publications)		395 (82.1)	203 (77.4)	156 (64.7)	82 (53.9)	73 (70.9)	42 (72.4)	5 (71.4)	3 (50.0)	NA	NA	NA	870 (75.4 ⁴)
JIF $\geq$ 5.0 (n,% of country's eligible publications)		113 (23.5)	44 (16.8)	30 (12.4)	7 (4.6)	21 (20.4)	9 (15.5)	2 (28.6)	0 (0.0)	NA	NA	NA	195 (16.9 ⁴)
IF $\geq$ 10.0 (n,% of country's)		21 (4.4)	7 (2.7)	2 (0.1)	2 (1.3)	5 (3.3)	2 (3.4)	0 (0.0)	0 (0.0)	NA	NA	NA	34 (2.9 ⁴)

⁴ Out of 1154 of the eligible publications with WOS JIF

[illegible]

Table S4. Summary of characteristics of stroke publications in ASEAN post-May 2020.

Country	SG	THA	MAS	IDN	VNM	PHL	MMR	BRN	KHM	LAO	TL	Total
Most common research categories												
<i>Risk factors and prevention</i> (n; % total)	85 (17.7)	67 (25.6)	32 (13.2)	18 (11.8)	6 (5.8)	12 (20.7)	1 (14.3)	2 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	198 (16.4)
Miscellaneous/ not classifiable (case reports, anecdotal evidence, overview of stroke) (n; % total)	71 (14.8)	14 (5.3)	39 (16.2)	33 (21.7)	15 (14.6)	10 (17.2)	1 (14.3)	0 (0.0)	1 (100.0)	1 (100.0)	0 (0.0)	165 (13.6)
<i>Recovery and rehabilitation</i> (n; % total)	73 (15.2)	36 (13.7)	36 (14.9)	14 (9.2)	6 (5.8)	4 (6.9)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	157 (13.0)
Outcomes and prognosis (n; % total)	61 (12.7)	26 (9.9)	14 (5.8)	14 (9.2)	16 (15.5)	6 (10.3)	0 (0.0)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	132 (10.9)
Diagnosis and hyperacute management (n; % total)	43 (8.9)	10 (3.8)	17 (7.1)	10 (6.6)	26 (25.2)	4 (6.9)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	105 (8.7)
Epidemiology (n; % total)	17 (3.5)	13 (5.0)	5 (2.1)	8 (5.3)	5 (4.9)	9 (15.5)	1 (14.3)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	47 (3.9)

Healthcare policy and socioeconomics (n; % total)	15 (3.1)	10 (3.8)	5 (2.1)	6 (3.9)	6 (5.8)	5 (8.6)	1 (14.3)	2 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	45 (3.7)
Decision-making and quality-of-life (n; % total)	10 (2.1)	8 (3.1)	7 (2.9)	3 (2.0)	3 (2.9)	1 (1.7)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	33 (2.7)
Others (n; % total)	106 (22.0)	78 (29.8)	86 (35.7)	46 (30.2)	19 (18.6)	7 (12.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	328 (27.1)
Study design												
Cohort (n; % total)	160 (33.3)	97 (37.0)	30 (12.4)	19 (12.5)	23 (22.3)	17 (29.3)	0 (0.0)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	328 (27.1)
Systematic review (n; % total)	73 (15.2)	24 (9.2)	37 (15.4)	21 (12.8)	10 (9.7)	9 (15.5)	0 (0.0)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	161 (13.3)
Case-report	39 (8.1)	6 (2.3)	32 (13.2)	28 (18.4)	20 (19.4)	6 (10.3)	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)	0 (0.0)	128 (10.6)
Cross-sectional (n; % total)	16 (3.3)	25 (9.5)	39 (16.2)	35 (23.0)	19 (18.4)	4 (6.9)	0 (0.0)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	127 (10.5)
Meta-analysis	67 (13.9)	13 (5.0)	13 (5.4)	20 (13.2)	6 (5.8)	3 (5.2)	2 (28.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	119 (9.8)

Descriptive	27 (5.6)	10 (3.8)	11 (4.6)	7 (4.6)	1 (1.0)	2 (3.4)	2 (28.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	53 (4.4)
Editorials and commentaries	31 (6.4)	4 (1.5)	11 (4.6)	2 (1.3)	3 (5.8)	6 (10.3)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	51 (4.2)
Randomised controlled trial	20 (4.2)	24 (9.2)	23 (9.5)	7 (4.6)	10 (9.7)	1 (1.7)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	79 (4.0)
Case-control	6 (1.2)	16 (6.1)	8 (3.3)	5 (3.3)	2 (1.9)	6 (10.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	34 (2.8)
Guideline	5 (1.0)	2 (0.8)	1 (0.4)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	2 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	11 (0.9)
Others	101 (21.0)	66 (25.2)	61 (25.3)	30 (19.7)	16 (15.5)	8 (13.8)	1 (14.3)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	250 (20.7)

Table S5. Correlations between socioeconomic markers and publication volume of total stroke publications and stroke-COVID-19 publications in ASEAN.

	Total Stroke Publications			Stroke-COVID-19 Publications		
	Rho coefficient	p-value	95% CI	Rho coefficient	p-value	95% CI
Population	0.415	0.205	-0.246 - 0.812	0.363	0.273	-0.303 - 0.791
GDP per capita	0.715	0.0133	0.202 - 0.920	0.800	0.00310	0.385 - 0.946
No of neurologists per million	0.615	0.0440	0.0240 - 0.887	0.782	0.00449	0.342 - 0.941
CHE as % of GDP	-0.155	0.649	-0.691 - 0.491	-0.270	0.422	-0.749 - 0.394
Change in % of CHE by govt	0.105	0.759	-0.528 - 0.663	0.344	0.300	-0.322 - 0.783
Change in priority to health (% of govt spending on healthcare)	0.164	0.629	-0.481 - 0.696	0.210	0.536	-0.446 - 0.719
R&D % of GDP	0.330	0.385	-0.428 - 0.816	-0.0544	0.889	-0.694 - 0.633
UHC Service Coverage Index 2021 from WHO Data	0.747	0.00823	0.267 - 0.930	0.684	0.0203	0.142 - 0.911
UHC effective Coverage index for stroke treatment 2019	0.565	0.0700	-0.0525 - 0.870	0.692	0.0184	0.157 - 0.913

Table S6. Correlation between percentage change in publication volume of total stroke publications and markers in changes in healthcare funding over the course of the COVID-19 pandemic.

	% change in publication volume		
	Rho coefficient	<i>P</i> -value	95% CI
CHE as % of GDP	-0.260	0.441	-0.744 - 0.403
Change in % of CHE by govt	-0.109	0.749	-0.666 - 0.525
Change in priority to health (% of govt spending on healthcare)	-0.434	0.183	-0.820 - 0.225
R&D % of GDP	-0.285	0.458	-0.798 - 0.468

Table S7. Top 10 journals in publication volume of eligible publications.

Rank	Journal	No. of Publications	% of total publications ¹	JIF
1	Journal of Stroke & Cerebrovascular Diseases	47	3.9	2.0
1	Frontiers in Neurology	47	3.9	2.7
3	Stroke	32	2.6	7.8
4	International journal of stroke	22	1.8	6.3
5	PLoS One	21	1.7	2.9
5	Cureus	21	1.7	1.0
7	Case Reports in neurology	20	1.7	0.6
8	Radiology case reports	19	1.6	0.6
8	Scientific Reports	19	1.6	3.8
8	BMJ Open	19	1.6	2.4

¹ Out of eligible publications (unique publications): n = 1,210